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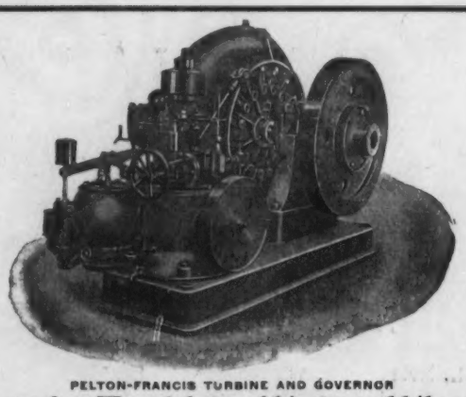

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THE STORY OF THE NEVADA POWER PLANT

BY ARCHIE RICE.

Archie Rice

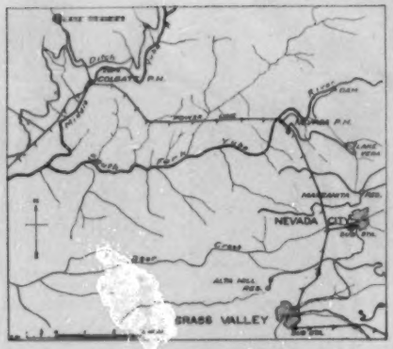
In the heart of mountainous Nevada County, where the miners' outlook is upon a green, corrugated world of Sierra ridges, tumbling up half a mile from the depths of winding canyons that carry the snow-water from the summits down toward the distant sea, there is a little hydro-electric plant, hidden at the bottom of a gorge and clinging just above the high-water mark of the South Yuba River.

There it has stood since the pioneering and experimental period of long-distance transmission of electric energy, and for the past thirteen years has continued constantly generating the subtle current and sending it five miles to the mines and homes of Nevada City and on three miles further to the mines and homes of Grass Valley.

Small, as measured by the standard of the gigantic plants of a later day, and comparatively more expensive of operation than those producing on a larger scale, this early arrival upon the scene of California's electrical development has gone on all these years generating night and day an average of 800 kw., a product, if measured at once cent a kilowatt-hour, representing earnings of nearly $1,000,000.

The South Yuba and the Mountain-side Flume from the Dam 3.1 miles Up-river.

Apart from the interest attaching to this installation in connection with the electrical development of a large number of rich mines on the mother lode, in the greatest gold-producing county in the Golden State, this Nevada power plant has a peculiar historical interest, because it was the nucleus of the Nevada County Power Company, which was conceived in 1891 and later (September 1, 1900) combined with the Yuba



Map of Nevada County, Cal.

The River Dam and Headgate of the Flume in 1895.

Constructing the Flume for the River Dam in 1895

Power Company to form the beginning of the Bay Counties Power Company, that grew until (March 1, 1903) its possessions, with others, were merged into the California Gas and Electric Corporation, a great system which (January 2, 1906) came under the control of a still more comprehensive concern, the Pacific Gas and Electric Company of today.

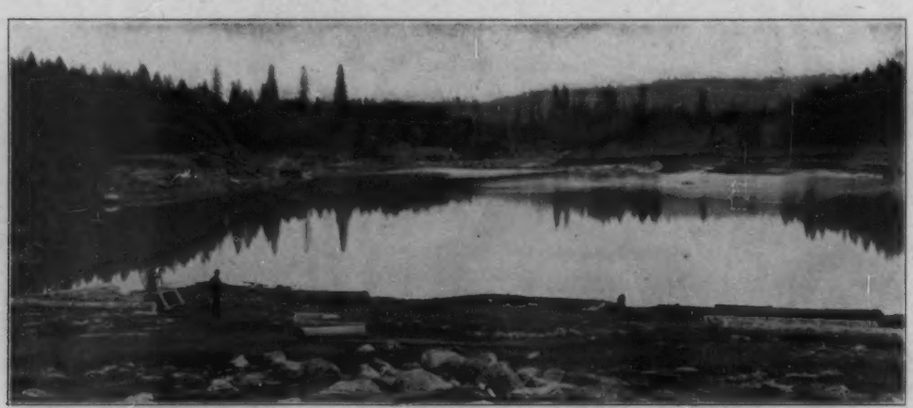
The creation of that earliest plant, based upon the principle of generating power produced by water diverted from a river and then led to a point where it would fall from a great height, was the idea of Eugene J. de Sabla Jr., a name associated intimately with many of the big hydro-electric enterprises of California.

"I owned some mining interests at Nevada City," he explained, "and I started by trying to get electric power for use in the mines. The problem was to take water by ditch from the South Yuba and, by a gradient less than the river's, carry it down to some point where a sufficient fall could be secured to operate electric generators. Land and water rights were acquired, plans made for the undertaking, a site selected for a dam, and, some three miles further down stream, a spot chosen for a power house at a point on the river about 1,500 ft. above the level of the ocean.

"But it's a joke—the calling of that little plant the 'Rome' power house. It is the Nevada power house. The nickname came about in this way: Romulus R. Colgate was associated with me later in establishing the plant at Colgate, over on the Middle Yuba. After that big one had been named for him, some of us got to referring to the little fellow over on the South Yuba as the 'Rome' power plant, 'Rome' being the familiar shortening of Colgate's first name."

The inception of the Nevada plant on the South Yuba dates back to 1891, when an effort was first made by de Sabla's proposed Nevada County Electric Power Company to put a dam across the river and prepare for a ditch and flume system. But in the spring of 1892 this original dam of logs was swept away by the fury of the flood waters.

With E. J. de Sabla Jr. as manager of the company and Alfred Tredgido as its superintendent another dam was started August 1, 1895, and it was completed November 20th. This dam was of logs piled crib-fashion, and it was bolted firmly down to bedrock in the river. It was 28 ft. high and measured 107 ft. across the crest from bank to bank at that point in the canyon. Before the cribs could be filled with rock and gravel ballast the river began rapidly rising, and the men had to abandon the work. Fortunately the "slickens" washed down from hydraulic mining districts formed so material a part of the turbid stream that every chink and cranny of the crib-work was soon packed solid with a deposit that made the dam more substantial than if it had been filled by man. Work on the flume for this dam had been started July 6th, and it was completed November 28th. The flume itself was made 6 ft. wide and 4½ ft. deep, and its construction took a force of 110 men working nearly four months and using 1,250,000 ft. of lumber. The grade was equivalent to a drop of 26 2-3 ft to the mile, and the distance traversed was 3.1 miles. Through this flume a constant flow of 5,800 miner's inches was to be delivered into a steel pipe, 3 ft. in diameter and 298 ft. long, down the final slope for an actual perpendicular fall of 190 ft. to the wheels. That was the full supply of water to the power house for the first two years of its operation. During October of 1896 Alfred Tredgido was succeeded as superintendent by L. M. Hancock. March 1, 1898, a crib dam 54 ft. high and 356 ft. across the crest from bank to bank was started in Rock Creek to back water up into a partially ex-



Lake Vera in the Formative Period, Looking Eastward From the Dam and Showing John Martin in the Foreground.

The Ditch Flowing into Lake Vera bringing Water from the Deer Creek Power House

Constructing the Lake Vera Dam in 1898

The Original Pole Line as built in 1895

cavated basin that had formerly been the scene of hydraulic diggings. It was completed November 27th. This reservoir area of about 42 acres was then named Lake Vera, for one of E. J. de Sabla's little daughters. Lake Vera had a storage capacity sufficient to furnish a constant flow of 1,000 miner's inches for a period of 30 days. A viaduct was constructed from this lake to convey water a distance of 2¾ miles through 2,340 ft. of flume and 11,404 ft. of ditch (most of it an old mining ditch) to a small forebay, on the hillside 1,870 ft. from the Nevada power house and 785 ft. above it perpendicularly. From this forebay the water shot down through a 20-in. steel pipe to additional impulse wheels installed in the same building with those originally established. After the acquisition of the Lake Vera source the 190-ft. fall secured through the flume from the dam on the South Yuba was called the low-head; and the 785-ft. drop produced by the viaduct from Lake Vera, the high-head.

While the low-head flume is supplied chiefly from the river dam, it receives a supplementary flow from another ditch that takes water out of the South Yuba 50 or 60 miles further up-stream. The high-head supply of water by way of Lake Vera comes indirectly from an enormous watershed catchment area of 121 square miles of Sierra slopes and snow-capped peaks in the region northward of the Southern Pacific railroad between Emigrant Gap and Summit. A series of 24 storage reservoirs, holding an aggregate of more than 2,000,000,000 cubic ft. of water, conserves the melting snows and the mountain rivulets of that vast area and forms the source of what is known as the Pacific Gas and Electric Company's South Yuba water system of 450 miles of viaducts. Part of the product in these 24 reservoirs is conveyed to the Auburn side of the ridge, and is carried off down that way as a great irrigating system for 13,000 acres of hillside orchards. The other part is conveyed toward Nevada City and Grass Valley for domestic and irrigating purposes in that region. This Grass Valley water supply comes down from Emigrant Gap through Main ditch, Chalk Bluff ditch, Cascade ditch and Snow Mountain ditch, and first forms the motive power for the company's Deer Creek power plant, which is at an altitude of 3,500 ft. After driving the Deer Creek impulse wheels, part of the flow is carried on several miles by ditch to form the main source for Lake Vera, which has a very small natural catchment.

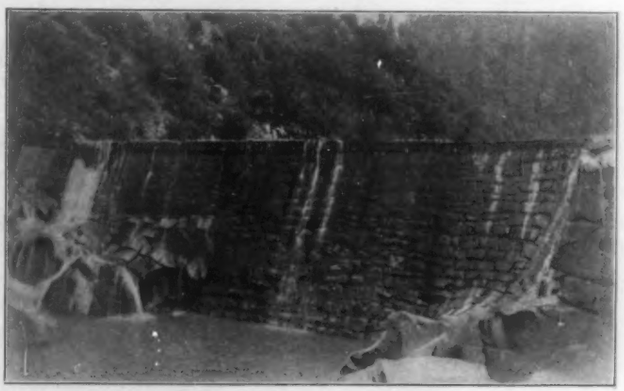
With the creation of the high-head supply from Lake Vera it was no longer necessary to maintain the low-head flow at the original maximum of 5,800 miner's inches, so the flume capacity from the river dam was reduced to 3,800 miner's inches, which is now its normal flow.

While the Lake Vera dam was being constructed in 1898 the flume and ditch leading from it were also made ready. This flume is 3½ ft. deep by 4 ft. wide, and has a gradient so gradual that the water takes an hour and five minutes to run from Lake Vera, a distance of 2¾ miles, to the small forebay above the power house. About two-thirds of the way from the lake to the lower end of the ditch is Myer's Ravine, a big gorge, across which the water is conveyed in an inverted, or U-shaped, syphon, a 36-in. pipe 668 ft. long, that crosses the canyon and connects the separated ends of the flume.

In July of 1900 George Scarfe succeeded L. M. Hancock as superintendent of the Nevada power plant, and, excepting one year, he has been the superintendent of that power division ever since.

April 2, 1905, a part of the Lake Vera dam, 29x30 ft., gave way and permitted an outflow that dropped the water level at the rate of an inch a minute. When the break occurred the depth of water in the lake was 52 ft. A force of men was rushed to the work of repair, and the gap was closed with wood and cement. The dam is now but 40 ft. high, and the storage capacity of the lake is equivalent to a constant flow of 1,000 miner's inches of water for only ten days instead of thirty.

In 1908 the original crib dam three miles up-stream on the South Yuba was substantially fortified with a granite wall on the down-stream face, 12 ft.



The River Dam as It Looks To-Day With Its Heavy Facing of Granite.

thick at the base and tapering to a thickness of 2 ft. at the top.

So much for the water power and its sources and channels.

As a business proposition the enterprise started under the name of the Nevada County Electric Power Company. The contract for the construction of the dam, flume and power house was given to John Martin, a name that in a few years was also to become widely identified with mammoth hydro-electric generating enterprises in California. The great installations that he and de Sabla created are all now owned by the Pacific Gas and Electric Company. The actual supervision of the construction of the dam and the flume was left to Alfred Tredgido, who became the Nevada County company's first operating superintendent.

While John Martin was harnessing the South Yuba for this power, Eugene J. de Sabla Jr. was busy in the Nevada City and Grass Valley mining districts interesting mine owners for the purpose of securing consumers for the proposed load. Many of the mine managers were skeptical as to the efficiency and practicability of this prospective transmitted river power, and during the first year of operation there were but few customers among the mines. The W. Y. O. D., the Homeward Bound and the Gold Hill mines in the Nevada district were the first to use the power, and they were followed by the Pennsylvania, the Brunswick, the Allison Ranch, and the North Star in the Grass Valley district, and then by the Mountaineer in the Nevada district. But no mine that installed a motor to take this electric power ever abandoned its use unless the mine itself was closed for some other reason. All that the enthusiastic de Sabla had promised came true. Those earliest installed electric machines are still doing the work in the mines.

The roads of Nevada County climb and dive and climb and dive again over ridges and through forests. They were built in the early mining days on the principle of "get there quick," without any attention to easy gradients or future permanence, and the same old roads have continued in use with little improvement in grades.

All the machinery for the Nevada power plant had to go by rail to Colfax, and thence on the little Nevada County Narrow Gauge Railroad across ridges and ravines to Nevada City. From there the problem was to get it to the site selected for the plant. The old wagon road for a distance of about three miles had to be widened in places and improved. It was all up grade. A stretch of nearly

The Nevada Power House on the South Yuba River.

two miles of new road had to be built up to the top of a ridge through underbrush, cactus, small pines and scrub oak and it was hard work.

Big teams, many of them 12-horse, were used to haul the heavy pieces of machinery up to the top of the "slide," 1,700 ft. elevation above, and

Hauling Machinery to Power House in 1865

half a mile from the site of the plant. Each generator weighed 11,200 pounds, and that was some weight to pull all that way up to the top of the ridge, just beyond the crest of which the loads were deposited.

Where the Massive Machinery was Unloaded at the Top of the Ridge to be Skidded Down half a Mile.

The Boarding House.

Then began the tug-of-war with men and heavy hawsers and stout cables cautiously sliding the valuable machinery down hill on skids mounted on log rollers, while big tree stumps served as capstans, from round which slowly to pay out the rope and lower away the load. The first 400 ft. down was by wagon. Then came the lowering by cables—400 ft. at an angle of 25 degrees, 600 ft. at an angle of 32 degrees, 80 ft. at an angle of 35 degrees, and finally 220 ft. at an angle of 39 degrees. In this laborious fashion the machinery was delivered to the narrow ledge that had been scooped off at the edge of the river, down in the bottom of the V-shaped canyon.

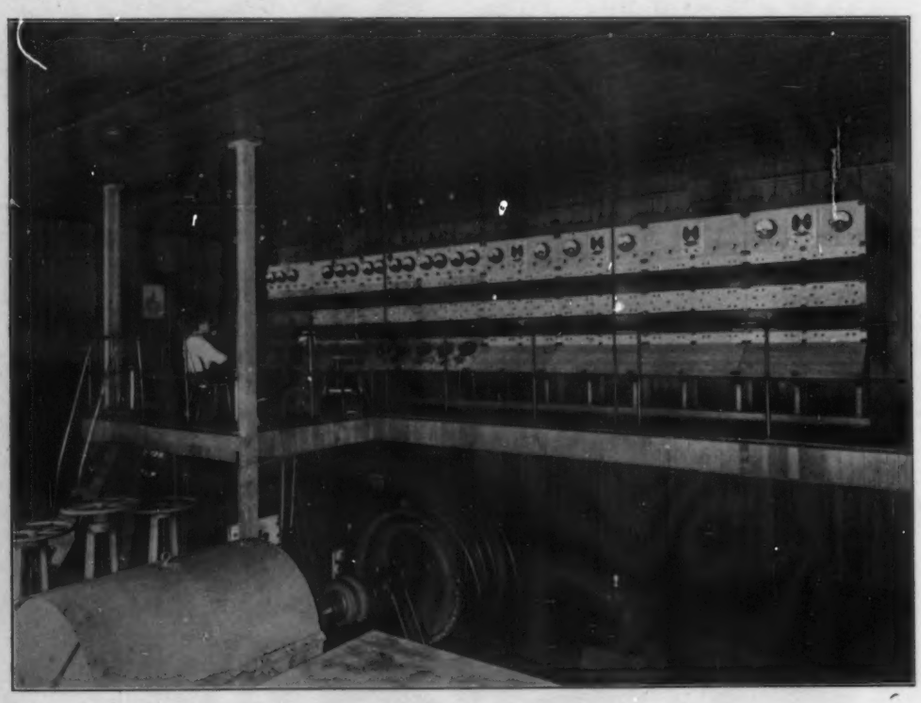
No plant could have been crowded into more cramped quarters than that Nevada power house and its boarding house. Each is hugging the river bank and backed into the wall of the canyon so tightly that they had to be placed on opposite sides of the stream, with a suspension bridge connecting them across the river itself. The rushing river water is their front yard, and there is no back yard.

The power house foundations are on solid bedrock granite. Steel rods ¾ in. thick are sulphured down into the virgin rock, and they rise perpendicularly through a bed of 18-in. solid concrete and come on up through heavy timbers to which they are bolted. Upon massive beams thus firmly secured rests the generating machinery.

Despite all the physical difficulties of the site, not a single mishap or delay occurred in the installation of that plant.

Along the last and steepest part of the "slide" the water pipes had to be laid and anchored to make them secure for the function of carrying the flume water swiftly down to drive the impulse wheels. As first installed, the low-head pipe went down in diminishing sizes to increase the density of the final jet. For the first 120 ft. the pipe diameter was 48 in.; for the next 100 ft., 44 in.; and for the last 100 ft., 42 in. This pipe discharged into a large steel receiver from which the water shot against the wheels.

For the original installation there were two 300 kw., 133-cycle, two-phase, Stanley, inductor-type generators, making 400 r.p.m., and generating at 5,500 volts. Each was direct-connected to 3-ft. Pelton impulse wheels. Three of these Pelton wheels were used on one generator and four on the other. The generators were guaranteed to have a commercial efficiency of 94.6 per cent and an electric efficiency of 98 per cent. Each of the seven Pelton wheels had two nozzles, and the two generators together developed about 800 h.p. The first switchboard consisted of open-air, automatic circuit breakers. They were supposed to break the circuit, but, as George Scarfe relates, "they did not always do it, and at times there were many displays of fireworks." But the deficiences of the equipment in those early days of hydro-electric generation have taught lessons that have been the means of producing many of the improvements and economies introduced into the plants later established. From the switchboard the two-phase lines were carried out through the end of a power house to an 8-mile pole-line ending at Grass Valley and having a midway branch to Nevada City. This pole-line was



The Switchboard in the Newer Part of the Power House.

run up hill and down in a right-of-way cleared 60 ft. wide through a brushy and timbered country. Round poles, cut from the right-of-way and reaching 30 ft. above the ground, were used, and on them were crossarms with triple-petticoat, white porcelain insulators, manufactured by the Locke Company. These insulators are still in use, but the poles and crossarms have all been renewed.

When the power plant was being built Grass Valley and Nevada City were electric-lighted by a series system from a small plant owned by K. Caspar, now proprietor of an electric-lighting system in Vallejo. The Caspar plant was bought by the new Nevada County Electric Power Company, and a substation established in Grass Valley and one in Nevada City. Step-down transformers were placed in these sub-stations to reduce the 5,500-volt current from the new Nevada hydro-electric plant on the South Yuba to a voltage of 2,200 for use in the mines. The small house transformers stepped-down this 2,200-volt current to a 550-volt current for small motors used in a foundry and in a planing mill, and further transformed it to a 110-volt current for city and domestic lighting.

The original installation proved so successful that demands began to be made for more capacity. Then it was that the Lake Vera dam was built and the high-head water power secured as a supplementary supply for the Nevada power house. To make use of this new supply of water, a corrugated iron building was erected in 1898-99 next to the original power house, and Tutthill water-wheels were installed to operate two more Stanley generators of the same size and description as the original two. These new generators each developed 330 kw. The high-head wheels were mounted on the same shaft as the low-head wheels that got their impulse from the river flume. A switchboard, with Martin open-air switches, was put in the new building so that all the machines could be operated in parallel.

When, in 1900, still more power was demanded, arrangements were made with the Yuba Power Company's plant at Colgate (now also the property of the Pacific Gas and Electric Company) by which a 23,000-volt current was brought over the ridges to Grass Valley, where four 200 kw. transformers were installed to lower the voltage from 23,000 to 5,500, so that it could be combined with the initial power from the Nevada plant. At that time 23,000 volts was high power to be sent over a mountainous district frequented in winter by heavy snowfall, and the old-time electric men used to go out at night occasionally and watch apprehensively to see how the insulators would endure under the coating of snowflakes.

In March of 1907, according to C. Boyd, its present foreman, the little Nevada plant held out through a terrific rainstorm that shut down all the other hydro-electric plants of the system. At no other station is there to be found greater pride in their plant than exists among the employees hidden down in that narrow canyon at the place they affectionately call "the 'Rome' power house," whose average production of 1200 kw. is small as compared with Colgate's 19,000 h.p. and Electra's 26,000 h.p.

THE PUBLIC SERVICE CORPORATION.[1]

BY C. L. CORY.

The original reason for the selection of this subject is because of my conviction that such matters as the public service corporation and the people, and social matters generally, are becoming now of as much importance to the engineer in the practice of his profession as, perhaps, the technical side of his labors; and there are a number of things that are perhaps of more importance just at the present time than they have been heretofore; and as I say, it was perhaps with that in mind that I first gave some thought to the subject of public service corporations as a proper subject to be seriously considered by engineers, and one which might well be followed up seriously by them.

Just as soon as I began to think seriously about the paper I could not but recall an incident not very many years ago when at a university not very far away, President McKinley was to be the main speaker, and, due to the illness of Mrs. McKinley, it was impossible for him to attend the commencement exercises of this university. As his substitute John Hay, then Secretary of State, was the principal speaker of the occasion; but on the program there were certain graduates who were to speak, and among the number was a young man (who now happens to be a judge of the Superior Court in one of the three largest counties of California) whose oration was on the subject of international law. When the members of the faculty who had charge of the arrangements for the day read this young man's address, they found it was about an hour long; so they said to him, that inasmuch as John Hay was to be the principal speaker, and especially as his subject was international law, it might be well for him to cut down his address to about five or ten minutes. That was agreed, but, notwithstanding, when the addresses were being made, this young man having first opportunity, he did not stop at the expiration of his ten minutes, and Mr. Hay had the high pleasure of listening to a learned discourse by a university graduate on international law. Later, and in a few concise words, those of us who were fortunate enough to be present had the pleasure of listening to some of the elementary principles of international law explained very clearly, and the contrast was of course marked.

I felt a little like that when I began to think of the subject of public service corporations; and it is only my intention, if I can do it, to confine myself to five or ten minutes.

In presenting a paper before the Institute treating on some phases of the public service corporation, I may say that in my opinion it is desirable that engineers should give serious thought to some of the problems inseparably connected with the subject, even at the expense of some neglect of purely technical matters. In the past twenty years great progress has been made in science and engineering. The present state of engineering development is due to the combined work of many minds. At the present time we may at least assume certain high standards have been

[1]Paper read before San Francisco Section of American Institute of Electrical Engineers, February 25, 1910.

unquestionably established, especially those of a purely technical achievement. Just now the situation deserves a little different treatment, and the engineers of today should be as well equipped to join in the solution of social problems as the men belonging to other professions. It is eminently proper, therefore, for engineers to take up serious subjects that are not necessarily technical, but which have a definite relation to any development, the success of which is based in part upon the highest technical consideration.

One essential difference between man and the lower animal lies in the fact that the former finds it necessary for him to serve his fellows to obtain the necessities, and sometimes, in addition, the luxuries of life, while, in contrast, the adult undomesticated animal has little else to do than to individually exist, and in some way for himself alone, obtain sufficient food to live.

Man must be a member of society whether he will or no, and in the present complex civilization his efforts can best be confined largely to the giving of his time to others. To serve as a slave is degrading, but in loyal and conscientious service one may give his best efforts and in the end rest assured that he will be appreciated and receive his due reward. Service to others is an absolute requirement for real success and applies to everyone. It is, of course, necessary to exclude the old and infirm, the sick, the mentally deficient, as well as idiots, and it is remarkable how many kinds of the latter there really are. The king as well as the peasant, the rich as well as the poor, the high as well as the low, all must, of necessity, if they really live, serve others. This service is, of course, of a different character in many cases, but there is no question but that one is truly estimated by the extent of their service, not for themselves, but for others. Every individual, whoever he or she may be, who covets name and fame; yes, even wealth, must sooner or later adopt this principle as a guiding factor in their conduct, and the degree of intelligence, industry, integrity and loyalty exhibited by the individual in such service will be a true measure of the ultimate success attained.

What is true of the individual is similarly true of a combination of individuals, who are joined together for the attainment of some particular thing which is impossible by a single individual. Therefore the principle applies as fully to what is generally known as the corporation, or in this special case, the public service corporation, as to the individual. The service desired by the many must be furnished by the one, and where the demand exists and is fully supplied, there is the greatest opportunity for competent and effective effort.

Just as some people succeed, it may be said that some corporations succeed, and as some people fail, so some corporations fall far short of real success. That corporation which has for its main and only object the making of money regardless of the quality of service rendered is as much a menace to mankind as the workman who works only for dollars and takes no interest in his work or in overcoming the difficulties which are constantly brought to his attention. Any man who would succeed must look to his daily work as a part of his life and at least obtain a certain amount of gratification by doing his work well; if possible, better than any other one could do it, and not have his mind completely absorbed in the contemplation of the compensation which from his standpoint should come to him. It would seem therefore that the public service corporation should have a broad point of view, and those responsible for their guidance should remember that they are a large part of the activity in the community which they serve, and that it is just as possible for them to be a material factor in progress as it is for the capable individual to do his share in improving the conditions surrounding him and his fellows.

We have come to think, and it is unquestionably true, that the large corporation is a necessity because no person could as an individual carry to a successful conclusion the great systems of construction and development work required to adequately provide all the service that is so consistently demanded at the present time and covered only in part by facilities for transportation, methods of communication and the furnishing of water, light and power service, as well as many other of the necessities, conveniences and even luxuries of life.

The corporations which provide such service come into immediate contact with the people and their representatives. To a group of engineers, then, the consideration of a few problems of importance to the people, and at the same time to the public service corporations, is a vital matter to them, since it is in the direct or indirect service of such corporations that many of us have our real opportunities.

We all know of the difficulties which have been developing and are becoming more and more serious in recent years regarding the rights of the people who are the customers and the real or legal rights of such public service corporations. From every standpoint I maintain that their interests are mutual, and that anything which affects the one affects the other, and that any serious investigation which is made should be so considered. Unfortunately many matters pertaining to the existence and conduct of the public service corporations have been treated and considered inadequately by the people through their representatives. The reasons for this inadequate, and sometimes even farcial, consideration of such matters are not difficult to find. They are real reasons of importance, and it is not my intention to minimize them. On the contrary, in this brief paper I wish to invite your attention to a few things of interest, as they really exist, to the public service corporations as well as their customers, the people. In so doing, no one more than myself appreciates that in all probability, viewed from the standpoint of the law, many things that I may say are justly subject to modification, but I hope at least, from the strictly engineering standpoint, to present for the purpose of discussion some problems in the solution of which the engineer may, in fact, should be, of much service.

One of the most important matters in which the people as well as the public service corporations are interested is in connection with the rates of service. What rights have the people in attempting to control such rates, and, on the other hand, what rights have the public service corporations, and may the latter

consider their property and the operation of the same as something which belongs exclusively to them, and in which there should be no interference whatsoever?

I will not attempt to go into details of the relative rights of the two as above suggested, but it may be said briefly that it has been established by the United States Supreme Court that many public service corporations are subject to investigation by the people in connection with the fixing of rates of service. As a result such investigations are now being made more or less thoroughly by the federal and some state and municipal governments. Public service commissions have been brought into existence, and while the results of their work have not as yet fully demonstrated the probability of ultimate success, yet in many instances the investigations are being made in a thorough and unbiased manner, and such investigations deserve the most hearty co-operation of the real friends of the public service corporations as well as the people.

Unfortunately, however, in the past in many instances attempts have been made to regulate rates by the representatives of the people when these representatives of the people have been entirely incompetent to do such work. It is also true that in many such so-called investigations the proper motive has not guided either the representatives of the people or those in control of the corporations. Such an ulterior motive is usually stigmatized for the one "politics," and for the other "greed," and there is no escaping the unfortunate influence which has resulted from superficial investigations, when the representatives both of the people and the corporations have in reality done nothing but fight for their own individual selfish interests.

It is the practice of engineers to treat conditions as they are and not complain or wish they were otherwise. It is probably just as well, therefore, for us to look into these matters, knowing that in many cases not only are the people unfortunately inadequately represented, but also that many public service corporations deserve as severe criticism on account of their consistent efforts to keep the facts from the public. In order that we may consider some of the present day questions from, if possible, a purely unbiased standpoint, I beg that you give attention to the following necessarily inadequate illustration.

I am frank to say that I gave much consideration to the formulation of a satisfactory illustration to bring out the importance of some of the things that are of special significance to the public service corporation and their customers. What I hoped to do was to be able to bring out in a simpler manner the question of the cost of plant, the investment, the true valuation—perhaps the difference between those expressions; also the cost of operation and the explanation of such terms as repairs, reconstruction, depreciation, obsolescence and terms that are more or less new to the present generation. I am quite sure I haven't succeeded in selecting a very complete illustration, but I think it will be of some help to us to more clearly see the ultimate result which should be attained.

Let us suppose that in the year 1900 a financial institution, such as a bank or trust company, among its other holdings, owned a comparatively small manufacturing plant for the purpose of making ready-made clothing, and for good reasons this manufacturing plant is located a number of miles, say twenty, from a city. This plant is to be supplied with transportation for material and employees between city and factory. Also the factory is to be furnished with an adequate water supply, gas, electric light, power and telephone service. The financial institution, having other use for its funds, and not being in the transportation business, nor the supplying of water, gas, electric light and power and telephone service, does not wish to make the investments necessary to furnish their factory with the service required. As a consequence it agrees with a single individual to provide all these classes of service with the distinct understanding that the individual is to be paid such rates for the service rendered as will cover all proper operating expenses, and in addition, allow a certain return upon the investment required. Further, the methods of keeping accounts are entirely under the control of the trust company, and let us in addition make the reasonable assumption that both parties to the agreement are honest in their intentions and efforts to do what is right.

Let us consider the matter of transportation. A private right of way is provided by the trust company and properly graded and macadamized. Probably in the year 1900 the individual undertaking such transportation would have decided that the automobile would be better to use than the horse, the use of an electric or other railway being eliminated solely for the purpose of our illustration.

When the time comes to adjust the rates of service, I think that we will agree that the first thing for both parties to obtain is a reasonably correct inventory of the entire equipment necessary to provide such transportation, and, second, determine its cost or proper valuation, since it is upon some such valuation that an adequate return upon the investment must be allowed.

I had in mind in the choosing of the private right of way something in the nature of a franchise. How would the individual who is giving this service continue to do so unless he were given the property of the trust company along the highway, properly graded? The use of that highway is granted as a part, if you like, of the agreement to provide the transportation service.

To contrast what is a fact in many cases where the rates of the public service corporation are supposed to be fixed by the people, what chance would the trust company and the other party to the agreement, the individual, have of agreeing upon the rates of service if the former maintained that the equipment of automobiles was worth but $25,000, and the individual should maintain that the proper valuation to place upon the equipment was $50,000? Who is to make or attempt to determine the proper valuation for rate fixing purposes? There can be no question but that it must be done by someone in some manner. As engineers we would say that such a valuation could be arrived at best by a commission or com-

mittee, the members of which are properly qualified to understand the details of the business. It should not be impossible to obtain reasonably accurate figures if sufficient time is taken and the work is done by competent people. A number of questions will undoubtedly arise as to the proper interpretation of the word "valuation." For instance, are the automobiles to be valued today at what they cost ten years ago, or what it will cost to replace them now? I have purposely selected the automobile as the means of transportation because during the past ten years the state of the art and the manufacture of automobiles has greatly advanced, as has the equipment of many public service corporations in even a shorter time. This and similar questions deserve the most careful consideration and should not be viewed solely from the point of view of the the customer or, in a similar manner, from the point of view of those interested only in the service supplied.

Great confusion certainly exists in the minds of many as to the proper interpretation of such terms as repairs, reconstruction, depreciation, obsolescence, etc. It must be admitted that no absolute definition of many such terms has been universally adopted. It is for this reason that great care is necessary in applying these terms to specific cases. There is, however, a real distinction between depreciation, obsolescence and repairs, and while it is impossible to definitely fix a line of demarkation between them, certain general principles are involved in determining the application of such terms.

Suppose, to return to our illustration, that ten years ago the individual who had started the transportation system purchased the best automobiles made at that time. During their use it is certain that some money would have been required to buy new tires, repair broken parts and in general keep the automobiles in good running condition, particularly as satisfactory transportation must be provided even during the worst weather and under extremely adverse circumstances. It undoubtedly would have been necessary to have reconstructed many parts of these automobiles. With all such repairs and reconstruction, however, it is quite improbable that today any one of these automobiles would be in use. No matter how good service they may have given, it would have been necessary to have entirely discarded them and to have purchased machines of a more modern type, not because they could not be used at all, and reasonably good service provided, but because the actual cost of operation would be materially reduced by taking the old type of machines out and replacing them with more modern and probably larger ones of the present day.

From one point of view a proper interpretation of the terms depreciation and obsolescence may be understood by the consideration of these old-style automobiles. All possible repairs and reconstruction, as from time to time required, was done to these old machines. Nevertheless, during the ten-year period, or perhaps even a less time, they became so far out of date and inadequate that it was necessary to discard them and replace them with new machines. It would have been unfortunate indeed for the individual providing the means of transportation if he had not had in mind each year during this ten-year period the time when such new machines must be purchased to replace the old, and probably the most satisfactory way would have been to have set aside each year a certain sum as a depreciation account which was to be used when needed to purchase the new equipment. It would probably be very difficult in the start to estimate accurately, without considerable experience, how long the old machines would be capable of use, or to put it another way, what would be the proper per cent allowance to be included in the total annual cost of operation for depreciation, obsolescence, etc. Experience and knowledge in such matters, when applied honestly to the different portions of any system, should give results not far from ultimate requirements. It is of the greatest importance, however, to segregate accounts so that the cost of repairs, both detail and general, do not overlap or be confused with depreciation or obsolescence accounts.

Carrying the illustration one step further, let us suppose that the trust company wishes the agreement, wherein they are provided the various services above enumerated, to continue in force for a period of fifty years. Let us suppose that in 1900 the output of the factory was not greater than 10,000 suits per year. During the ten years from 1900 to 1910 the factory has grown so that the output is now 100,000 suits per year, and that during the remaining forty years covered by the agreement, there will be continued growth at a rate, maybe less or perhaps greater, than during the first ten-year period.

As the factory has increased its output ten times, it will have been necessary for the individual to have increased the investment in his transportation, water supply, electric light and power and telephone service. Referring to the transportation system only, let us suppose that the net earnings have been $10,000 per year, but that due to the growth of the manufacturing plant it has been necessary for him each year to add new automobiles costing $20,000. Should not the return or percentage allowed upon the investment be affected somewhat by the continued increase in the amount of investment necessary to supply satisfactory transportation service?

Here we have a situation which is readily compared with that of many public service corporations. Notwithstanding the fact that what is usually termed a reasonable return upon the investment is assured and also that they may be in exclusive control of the service required, yet each and every year in order to keep pace with the increased demand for additional service, an increased investment is required equal in amount to twice the net earnings. The rapid growth of American cities and communities has developed many such instances in the development and operation of public service corporations.

Again let us suppose that during this ten-year period just ended, instead of the individual having the exclusive right of furnishing transportation, water, gas, electric light and power and telephone service, as a result of the rapid growth of the manufacturing plant he had been compelled to continually provide against possible competition, which, if allowed, would have divided the gross receipts between himself and one or more others. It is quite apparent that if the

trust company allows a reasonable return upon duplicate investments there can be no question but that the introduction of a second or competing system will result in increased payments by the trust company, and as long as the party to the original agreement provides adequate facilities for the constantly increasing demands, the fixed charges and operating expenses should be less with the one system than with two or more independent ones, since the trust company is really paying such rates as will give an adequate return upon the investment.

Again, suppose the individual is desirous of selling out his transportation business to another who undertakes to fulfill the original agreement. Shall the exclusive privilege to use the private right of way provided by the trust company be considered of something of definite value, and therefore properly included in the investment required by the transportation system in the determining of proper rates? The exclusive use of the highway by the individual covering a period of fifty years might be considered as a franchise. Originally it was provided to the individual free of all expense to him. Should he, in turning over his assets to his successor, use this exclusive privilege as an asset of fixed value, and expect the purchaser to include in the purchase price an agreed sum for the privilege, or for rate fixing purposes should the exclusive use of the highway owned entirely by the trust company be capitalized and included in the valuation agreed upon for rate fixing purposes? In the beginning of the agreement with the small manufacturing plant, the exclusive use of the highway might have been of little value, but when the plant has increased its output tenfold in as many years the exclusive privilege or franchise may have, and in all probability has, greatly increased in value.

Unfortunately when we turn from the above illustration and consider the people on the one hand and the public service corporation on the other, we do not usually find the hearty co-operation which was assumed a necessary part of the agreement between the financial institution and the individual to whom was entrusted the supplying of the required service. The fact is that the people as a rule are as suspicious of public service corporations as the latter are suspicious of the so-called representatives of the people. It is much easier to enumerate the many difficulties than to suggest remedies to improve the conditions existing. In this brief discussion I will not attempt to enumerate the many reasons for the lack of confidence between the people and the public service corporation. Suffice it to say that the methods of investigation which are common in connection with rate fixing in many instances are not only misleading, but are so superficial as to lead to absolutely no definite results. On the other hand, the methods of financing public service corporations, involving the issue of bonds and different class of stock, on a purely speculative rather than investment basis, tends to develop a lack of confidence on the part of the people, which is not at all surprising.

In conclusion I beg to offer a few suggestions which may be readily inferred from the above discussion.

If it has been judicially established that the people have a right to adjust rates of service, one of the first things to do is to obtain a proper appraisement of the plant from which the amount of the required investment may be derived, with the ultimate end of obtaining a figure which shall at least approximately represent the proper valuation for rate fixing purposes. Where possible competition, by virtue of the circumstances, must be constantly kept in mind, the investment necessary may properly include unused parts of the plant or certain property, the acquisition of which by an opposition company would seriously jeopardize the earning capacity of the first.

In determining the proper valuation for rate fixing purposes adequate loading charges should be added when the inventory and unit costs include only the first or original cost of materials and labor. Such loading charges, if the work is not all done at one time, may quite properly include a percentage for piecemeal construction, and may always include a proper allowance for engineering and supervision, casualty insurance, interest during construction and similar items properly compounded. I am quite aware that it is not an easy matter to accurately determine the proper percentages indicated above, but, nevertheless, I am of the opinion that the consideration of such so-called loading charges will in any specific instance very materially assist in obtaining the proper valuation upon which a return upon the investments is to be allowed.

Depreciation charges should be included in estimating the annual cost of operation. The greatest care must, however, be taken in properly determining the amount of such depreciation charges, and the different parts of the plant should be considered separately in obtaining the average depreciation for the entire equipment.

Many public service corporations are natural monopolies and no amount of competition in such cases can improve conditions or provide cheaper or improved services to customers. For such, viewed solely from the interests of the people, exclusive rights or franchises should be granted, but only when the most complete and absolute regulation of rates intelligently carried out is included as an integral part of the agreement whereby the sole or exclusive rights or franchises are granted, either for a period or in perpetuity.

The representatives of the people, whether such represent the federal, state or municipal governments, should in a most thorough and complete manner procure all the data necessary to equitably fix the rates of public service corporations, and in so far as possible it would be of advantage if the public service corporations would give to the public detailed information as to the real cost of their systems and the expenses of operation. If this were done the people might appreciate to a large degree the difficulties which must be successfully overcome in order to give good and satisfactory service. Finally, it is quite necessary that the public service corporations give to the representatives of the people every opportunity for them to obtain all the information and data required to, with fairness to all, fix the rates of service.

DISCUSSION ON THE PUBLIC SERVICE CORPORATION.

At the conclusion of C. L. Cory's paper on "The Public Service Corporation" was a discussion in which the following participated:

C. W. Burkett, General Superintendent of Plant, Pacific Telephone and Telegraph Company, San Francisco, Chairman.

John A. Britton, Vice President and General Manager Pacific Gas and Electric Company, San Francisco.

R. B. Daggett, Daggett, Reed & Co., San Francisco.

A. H. Halloran, Managing Editor Journal of Electricity, Power and Gas.

W. A. Hillebrand, Instructor in Electrical Engineering, Stanford University, California.

H. T. Cory, California Development Company.

W. H. Seaver, Pacific Coast sales agent American Steel and Wire Company, San Francisco.

George C. Holberton, Manager San Francisco Gas and Electric Company.

M. M. Libby.

C. L. Cory, Professor of Electrical Engineering, University of California

John A. Britton: I could not forbear coming here when I heard the title of the professor's paper, because I know of nothing else in life except public service corporations, and I have appreciated that it was about time that engineers, classed as such solely, should take up a side of their business other than that which the professor has rightly said is the purely technical side.

The engineers of today have more to do with a consideration of the financial end of the corporations which they serve than they really have with the engineering. They are the influential factors in determining whether an investment will be a profitable one; and, secondarily, they must show the investors that the results of the expenditure of money will be profitable; and to do that they must deal with all of the questions that the professor has brought out in his very able paper tonight.

Public service corporations are of very recent growth. The first public service corporation known was a gas company organized in England in the latter part of the last century. In 1797 the discovery of illuminating gas was first given to the world. That brought about the service of that commodity to the public, and from that grew public service corporations. The railroads were the next that have come in under the cover; then followed the electric light and power interests, and subsequently the telephone.

Public service corporations today, in my judgment, are responsible for all of the contumely heaped upon them by the press and the public. They have nothing but apologies to offer, and they are suffering largely from the sins of their predecessors, and some of them are today suffering from their own disease of corruptness. One corporation having a poor policy can so taint the pure water of the rest that all of the water is bad.

The education of the people and the education of the public needs to come right through the engineering class today. The business man is not a fit one to appear before rate fixing bodies. He is colored too much—his views are in accord with his own desires. The engineer stands between as a factor looking only at the right side of the proposition, having no particular views of his own, and judging from most engineers that I know, possessing no stock and bonds in the corporations they are pleading for, and therefore have no monetary interest excepting their monthly stipend

The question of rate fixing is new also. It began with the adoption of the present constitution of the State of California in 1879. Prior to that time, so far as I have ever been able to learn, in no State in the United States was any attempt ever made to fix rates for any public service corporation. That constitution, as you know, was born in the sandlots in San Francisco; it was practically created by Dennis Kearney, who, through his wonderful magnetism and his wonderful power as an agitator, brought about the question of a new constitution in this State. The constitutional convention was composed probably of the brightest men in the State of California, who were at that time impressed not only by the press of the country and of San Francisco, but by the attitude of the people themselves, with the necessity for some reform measures against the corporations which had up to that time been dominating the State of California. So the action of the constitutional convention was more or less drastic in its character, and the particular provisions in it that are obnoxious today, from a fair point of view, were the direct result of the attitude of corporations towards the public at that time.

The rate-fixing was particularly directed to the water companies of the State. There was one provision inserted, Article 11 of Section 19, which provided that anyone could occupy the streets of any city or incorporated town in the State of California free of any franchise privilege for the purpose of laying conduits for supplying the inhabitants "with gas-light or other artificial light," electricity, of course, at that time being an unknown quantity; and giving that privilege with the understanding, as stated, that the municipality should have the right to fix the rates to be charged for the service. Under that provision of the Constitution—which, by the way, was an amendment of the original constitution, adopted in 1883, the municipalities of California have had the power, sustained by the highest courts of the land, to fix and determine the rates.

Subsequently, possibly four or five years after that, the agitation in the matter of fixing rates began throughout the Eastern States, Massachusetts being the first State to take up that question—Massachusetts, the most conservative State in the Union, a State where investments are safe and where they are protected, went about it in a business-like way and instituted a gas and electric light commission, which has existed ever since, and whose decisions have never been disturbed, and whose justice has never been contradicted. It stands as a monument of all rate-fixing matters, as the only basis on which justice can be done to the public and to the corporations. You know, possibly, it has been followed in Wisconsin and New York since.

Briefly, that is the history of the rate-fixing. Today in California rate-fixing is a farce. Acting upon the authority granted by the Constitution, the several bodies throughout the State summon all the public-service corporations annually before them to render statements, which are as Sanscrit to the men who pass upon them, which contain statements that they cannot understand, and, in nine cases out of ten, that they cannot comprehend; for the man who is earning one hundred dollars a month can't think in millions. Yet the law and the men are not to blame. The law has put that burden upon them to pass upon the rates. They are between the devil and the deep sea. (Whichever of those the corporation is, I don't know.) They solemnly sit there; they listen to the pleadings of the corporation president, or the corporation engineers, on values and revenues and expense. They are none the wiser when they get through. They ask some very intelligent questions occasionally. More often they don't know what to ask, and they perfunctorily pass an ordinance fixing a rate that determines nothing, and the corporations, as a rule, have been forced into the courts, intensifying necessarily the feeling against them, and creating the great unrest that prevails.

The press don't help matters, either, rarely taking the side of the corporation, even if they know the corporation is right. It is not good policy to do that. They are catering to the people, and the attitude of the people today is more or less anarchistic, and they cannot be blamed for it. When wealth is used as it is today, and flaunted in the face of the poor struggling workman, it is no wonder that the public as a class rise

up to smite the man with the money, because they are taught to believe that he could not possibly have come by it honestly.

In fact, David Starr Jordan said, the other day, that he did not believe that any man ever honestly made a million dollars. When you have the president of one of the great universities of the world making an assertion of that kind, how can you blame the ignorant workingman who allies himself against capital, wherther individually held or corporately held? The mission of engineers today should be to go out and preach the gospel of the defense of capital honestly invested, and if they believe in the corporations they could do it. If they do not know that the corporation they are working for is honestly capitalized, and that they are asking only for honest returns on that money, it should be their business to find out from the corporation, advise themselves, and then go out and preach that gospel. For capital needs the same protection that the man working for the corporation needs himself. I am assuming now that corporations are only asking today that amount of revenue which will yield a reasonable return upon the amount of money honestly invested; that it is only asking its expense account, a reasonable amount outside of the known factors that go to make up the actual expense of operation, maintenance and distribution in every business, and that which will constitute the much-troubled question of depreciation.

Engineers will always disagree upon what constitutes depreciation, and I don't believe it ever will be determined except in one way. I think that question could be solved in this manner: Corporations insure the fidelity of their clerks; they insure their property from destruction by fire; they insure themselves against accident to the people in their service. It seems logical to me to follow out that idea, that there should be and could be an insurance against depreciation.

If I today were to organize a company with a certain capitalization, and come to the Home Telephone Company, and say, "Gentlemen, I will make an appraisement of your property today, its value——" Or, take an older company, such as the Pacific Telephone and Telegraph Company, which has an older plant, that has been in use, and appraise it as it is valued today. "Now, I will insure that property against depreciation for a certain percentage"—I bearing in mind, of course, that what I will receive as a premium I would invest in some other securities which would yield an interest; that I would be earning money upon that premium all the time. I would agree for a term of fifty years to replace any worn-out part of any apparatus belonging to this company that had depreciated, the determination of depreciation as against mere maintenance or repairs being decided by the company itself as to what had depreciated. The company would pay me that premium. It would be a charge on their books of money actually paid out for insurance of the perpetuity of its plant, and would solve the question if the percentage which I claim for them could be deemed to be reasonable.

Those of us who have been in the business for a great many years have knowledge of what depreciation really means. I don't want to be egotistical nor tell you how old I am, but I have been in one business for thirty-five years. That would be time in which a plant that I began with, if it had faded away entirely and disappeared, would figure out a little less than 3⅓ per cent depreciation. I know from thirty-five years' experience in gas plants, and from more than twenty-eight years in electric lighting plants, what depreciation and obsolescence really mean from practical experience, and I know this: that a gas plant, in its entirety, with the exception, perhaps, of its gas mains laid under the streets, has a life not exceeding ten years on an average. Gas mains would have a life approximately of fifty years, possibly of seventy-five. I know of pipes in the ground today that have been in the ground for over fifty years, which, for the purposes of the business they are engaged in, are carrying the gas as well as they were fifty years ago. Steel structures as holders have a life of not to exceed thirty years, when they will have to be absolutely replaced. And so you can go down along the line of depreciation, and you can get men who have been in the business today long enough to determine just what the natural percentage of depreciation would be.

There is one thing over and above all else that has impressed me very much in corporate service; that is, that the corporations don't have their ears to the ground, in the first place, and they don't get next to the people, in the second. The characteristic of every corporation up to within a very few years has been to hold the public away, and not in any respect to take the public into their confidence. That spirit, entertained in the head offices of the company, goes down through the line of employees. Like master, like man.

But a few years ago the public-service corporations awoke to the fact that they were making a great mistake; that the public were getting stronger than they were, and they had to change their tactics to preserve their lives and reputations. Every corporation today in the United States that serves the public is doing all it can to cater to the public and to bring the public nearer to it, but they are not going far enough. The public only hear one side of a controversy, and that is through the daily papers. Conceding that the press talks to a biased public, the public-service corporation makes no effort, except in the way of advertisement, to reach the public. Advertisements are read, as all advertisements are, with certain grains of suspicion. I believe if the public-service corporation, through its trained engineers and employees, can get down from their pedestal to the level of the people, and walk with them hand in hand, in some way they can educate them, because the public want to know; they want to be taken into your confidence, and they want to believe you are right, and they will respect you because of your coming down and walking hand in hand with them.

That can be done in many ways, such as a more frequent appearance before the public of the officers and engineers of the corporation upon the technical side. The people are ignorant of what constitutes the phenomena, if I can call it that, that they are dealing with every day through the public-service corporations. They don't understand the mysteries of the automatic telephone service. They don't even know the Bell service, or what they do to carry sound such distances. They are perfectly dense as to how electric energy is produced and distributed. They haven't the remotest idea of how gas is manufactured, or what from, or what constitutes gas when it is manufactured. The schools don't go to the trouble to give them information on that point. The universities don't go to any particular trouble except in a general, technical way in electrical and mechanical engineering, and a little dab of gas engineering, leading up through the classes to graduation; so the student who graduates from the universities of this country, while he has a general theoretical knowledge of the elements of the sciences that enter into the business largely of public-service corporations today, has to begin all over again.

He is like a bookkeeper who has graduated from one of the business colleges, and goes into a mercantile house to keep a set of books. Before he can keep the books of the concern he has to learn its system. He has some of the fundamental principles, but none of the really practical ones. You cannot do otherwise in college. You cannot make specialists of men. You cannot put a man straight to a particular course and specialize him to one thing, and turn him out an absolutely practical, thoroughly trained electrical engineer. It would be too much to expect of the college to do that. There are too many other things for them to do; but what could be done is this: that if the men having the practical knowledge and experience from years of service in all of the things that the public-service corporations are engaged in doing, could spend a few of the dollars of the corporation in going before the children in the primary schools, the children in the grammar schools, and the boys in the technical schools, and the young men in the universities, and deliver weekly, if you please, lectures on the different topics, they would then be educating the young men as they

grew up in a proper way in that particular line with which, as citizens, they are going to have so much to do, and of which, as citizens, when they come out of the schools, they know so little. That is where the difficulty lies—the lack of education of the youth and people of today with regard to these matters. And I would go further than that. I would see that popular lectures were given here from to time, and they would become popular after a while—illustrated lectures, lantern-slide exhibitions, dealing with these complex studies. Bring in the people, the consumers, and educate them. Make an open book of your accounting to them. Prove to them positively that the statements you are making are correct, and gradually this feeling that exists against public-service corporations would fade away as the dew does before the morning sun.

It can be done, but it rests with you young engineers growing up the service of corporations, or in engineering work if ing up in the service of corporations, to so educate the people that the sciences to which you are devoting your life and that you spent your school-days in trying to acquire, would be used for the benefit of the people. Because if you can relieve the people of their bias and their prejudice, and get them to thinking for themselves, and thinking rightly and honestly, without bias or prejudice, you have accomplished as much as an engineer as you have in building any structure, no matter how grand it is.

I apologize for all this time, and I am very glad to have been able to say these few things to you. It is a subject that cannot be discussed in an hour, nor a day, nor a month, and if I can set any one of you young men here thinking, to go out and preach the gospel of fairnes to capital invested, which is for the benefit of the people, I won't have talked in vain; and I thank you, professor, for the opportunity you have afforded me by your paper to say this, and I thank you all for your patience in listening to me. (Applause.)

R. B. Daggett: The subject has been of great interest to me for several years. In a very small way I have attempted to do something along the lines suggested by Mr. Corey and Mr. Britton. It has always been my idea that the principal difficulty between the people and the corporation was that they did not understand each other. Of course, as Mr. Britton has said, some of the differences are due to what has taken place in the past, and abuses by corporations in the past have made it difficult for corporations to exist under right conditions now. Over in our town of Berkeley across the bay, we have a little club which meets occasionally, whose members are business men. Mr. Britton has said that the thing for the corporation men to do is to get next to the people. Now I am going to ask him sometime to come right over there and get next to us, and I am going to ask Professor Cory to do the same thing; and I think if we could get a few men who are known only in the newspapers as they appear sometimes in cartoons, and are not known at all as the men they are, to come before the people, why, a great many of these cobwebs would be brushed away.

C. W. Burkett: It was my good fortune to be in Wisconsin at the time the well-known Wisconsin commission was established. I was also at that time connected with one of the corporations that operated in the State and which was placed under the commission. I remember very distinctly the sort of dread with which the corporation looked upon such an investigation as a commission of this character would make—not so much because they did not have a good story, but they really had not thought about it long enough to know they had a good story. I believe it is the sense of the corporations operating in the State of Wisconsin today—at least the major part of them—that the commission there, which is composed of one engineer, one attorney, and one business man—has done a great deal towards establishing friendly relations between the public and public-service corporations in the State.

There is one thought in connection with Professor Cory's paper that I wish to mention, and that is that the average engineer, the engineer of today, as a rule has not given enough thought to accounting. Accounting, to the average engineer, is something that must be left to auditors. He must not know anything about it. That is one of the most serious mistakes that the engineer can make. The time has arrived that a man is not an engineer unless he is an accountant; and by accounting is meant the proper classification of all expenses in connection with any operation—a classification that will show costs.

The matter of the proper valuation on which to base rates is probably one of the greatest problems in rate-making today, and I will not attempt to discuss it, because I am not prepared to do so at this time. As to whether rates should be based upon first cost, which means the money actually put into the plant, or whether they should be based on what is known as the replacement cost—being the cost of reproducing the property as it exists today, or whether rates should be based on what is termed "going value", are all matters which have been and are being discussed by rate-making bodies today, such as State commissions and municipal commissions and investigating associations. There seems to be a sentiment at this time that the proper valuation upon which to base rates is the "going" valuation. The State of Washington has a railroad commission with a corps of engineers. This commission has done quite a good deal of work in connection with the railroads operating in Washington. Its method has been this: The engineers first established what they call cost. They made every effort to secure a figure which was the cost of the property. They next prepared for the commission another figure which they call replacement value, being what it would cost to replace the property today. After having prepared these two sets of valuations the engineers then gave the figures to the commission. The commission then arrived, for rate-making purposes, at what they were pleased to call a "going" value. This "going" value in the State of Washington, as I recollect it, was about 20 per cent higher than the replacement cost of the property.

I was quite interested in Mr. Britton's suggestion, that it might be possible to take care of depreciation through an insurance scheme, and it occurred to me that there might be some real merit in the suggestion, and that here might be an opportunity for a business undertaking of considerable importance.

A. H. Halloran: The "going value" mentioned by Mr. Burkett is now the subject of widespread discussion among those interested in the appraisement of public utility plants. It includes not only the physical value of the equipment, but also that intangible value which is attached to anything that is alive. No satisfactory definition has yet been given for this term which has been but recently coined. It will be but a short time, however, before the "going value" will be recognized as one of the most important factors effecting property valuation. Its most vital part is the element of "good will," that friendly feeling which Mr. Britton shows has been indifferently cast aside by some corporations. A company giving service to the public without the good will of that public is actually worth less in dollars and cents than is a company which has the hearty co-operation of its consumers. Just as good will is a corporation asset, so is its absence a corporation liability.

Mr. Britton has already shown how this good will can be created by educating the public about the company's work. Remove a little of the mystery that is attached to electricity and the secrecy that is associated with accounting and you will bring forth a popular sympathy whose value may be compounded annually.

The popular ignorance about the subject of reconstruction is surprising. It is not difficult to show that this reconstruction is necessary to take care of the wear and tear of daily use and is consequently as legitimate an expense as are the bills for lubricating oil. Many people have an idea that the charge for reconstruction is made to enhance the company's financial value much as reconstruction increases the worth of a ruby; moreover, that this increased valuation is as fictitious as is that of the artificial stone dug out of the crucible, which the jeweler is trying to sell as a genuine gem dug out of the ground. By citing a

maintenance expense with which everybody is familiar, such as the cost of mending a leaky roof, it is easy to make most people understand why this charge is made.

The matter of depreciation has been greatly systematized by engineers in the past few years. The telephone companies, in particular, have even plotted curves from which they deduce an annual depreciation charge, say 8 per cent. These charges, like those of cost data are not universally applicable. We cannot estimate depreciation value for the climatic conditions of California which would apply to the conditions in the East. Consequently every company in each locality is compelled to estimate its own depreciation account.

Now, a word of warning as to this scheme of governmental regulation which is being held as the panacea for all the evils of corporation misrule. Undoubtedly regulation in moderation is a good thing, but if carried to the extreme of governmental operation of public utilities, under our present form of government, we will be involved in difficulties of which we do not now even dream. In California we are suffering under too much municipal regulation. The tendency throughout the country is evidently toward State regulation and quite possibly national regulation of corporations. As long as these regulating commissions confine their efforts to the protection of the public and of the stockholders by deciding a proper rate for service, all will be well, but as soon as they attempt to dictate how the property should be operated they will meet with much the same troubles as do the labor unions when they try to say who shall and who shall not be employed. In other words, if corporation regulation be carried one step further to governmental operation then it borders on the socialistic, and is contrary to the principles of our American government, the principles upon which our past success has been based.

W. A. Hillebrand: I would like to ask if you mean that the good will of the consumers should be capitalized; and I would like to ask Mr. Burkett, in relation to the remarks he just made, if he knows why 20 per cent was added to the replacement value to make going value?

A. H. Halloran: The question of whether the good will of a corporation can be capitalized is a good deal the same as whether its franchise could be capitalized. The franchise is what the people give, very often for nothing, but within a few years that franchise acquires a definite value. If we were going before the Supervisors and say, "We are attempting to capitalize our good-will," we would be laughed at; but if we have a property for sale, and can show we have a certain stock in hand, and are supplying a certain demand, very good; furthermore, if we can show we have the good-will of the people we can get a better price than if everybody's hand is turned against us. At least it would be more salable and more likely to be acquired by a possible buyer.

C. W. Burkett: In reply to the second part of the question as to why the State of Washington added 20 per cent and called it "going" value, my understanding of that is this: There are many things done with a property that make it worth much more as a financial proposition than the amount actually expended on the same. Should earnings be based on the money put in the property, or on what the property is worth? Supposing you built a plant twelve years ago when copper was 12 cents a pound, and you tried to make rates two years ago when copper was 28 cents a pound, what valuation would you use for rate-making?

Question: Wouldn't that difference be taken into account in the replacement value—that is, the company is entitled to the increase in its value?

C. W. Burkett: I have read a great many discussions and talked with a great many people on this subject, and it is not clear to me, by any means, what is the right thing to do. What we are after is "the right." As I attempted to explain, the commissioners in Washington have arrived at the use of a "going" valuation upon which to base rates, for the reason that the property is worth that much; that is, what it would bring in the market today.

Question: What I am trying to get at is the reasons for the 20 per cent on what the replacement value is.

C. W. Burkett: A concern has, for example, contracts with other companies, which are valuable, which have not cost anything, perhaps, and those contracts have a very real commercial value. As to whether that should be capitalized or not, whether rates should be based on that valuation, is the problem; but that is the way I understood the Washington commissioners decided was equitable.

John A. Britton: The question of the value of the plant, based upon its being a going concern has been covered by a number of decisions in the Supreme Court of the United States, where that question has been discussed and argued. I think it is a good deal like good-will, in a way. Of course, no one for a moment (to take a concrete example) would suppose that the "White House" would sell you its business tomorrow based upon the value of the stock it carries on its shelves. It has a good-will as a going concern, having an established reputation, location, and so forth. And that goes into the question in the courts, as to what constitutes a going concern value, much upon the lines that Mr. Burkett has suggested, of contracts in existence. But in railroads, more particularly, they have argued that it applies as well to the pioneering efforts of the company in opening up territory, in building for itself a business that before was not there and from which no revenue was obtained, and succeeding by opening this territory in making that a tributary, profitable business, that that should enter into the valuation besides rights of way and rolling stock. In other words, it has built up a going business that has created trade, and that has a capitalized value. In fact, the Supreme Court of the United States, in the Consolidated Gas case, went as far as to say that by reason of the possession by the gas company in New York of a monopoly, due to the fact that the municipality would never countenance the tearing up of its streets for the general laying down of conduits for conveying gas, it was entitled to have considered, in the appraisement of its value, this value of a monopoly; it suggested as a possibility that might be considered. It did not rule on that point. But the Supreme Court has in many cases decided that the operation of any public service, in developing territory and producing a revenue, by that means constitute a certain capital over and above the intrinsic value.

While on my feet I want to say this, that in California we have been confronted with the decisions of the State courts that only permit corporations to take into consideration the matter of valuation in fixing rates, the absolute value of the property actually in use. If considerable of the property of the company has been bought to stifle competition, to shut out possible reservoir sites, or obtain valuable rights of way, that would not be considered if not actually used, nor would vacant property, bought years ago for possible use and never used, by reason of the business, or absorption of competitors, or otherwise, that they could not obtain a revenue on that, and that would not be allowed by the courts; but other than that they do allow and will allow, I think, in all future times, a value over and above the question of intrinsic values as a going concern for the business developed.

H. T. Cory: I am not a member of the American Institute, but I am a member of the American Society of Mechanical and Civil Engineers, and I have been very much interested in this talk this evening. I was no little surprised to hear Mr. Britton say he would be very willing to enlighten the public as to public corporation affairs. I have been until very recently general manager of two corporations, one on the American side of the line and one on the Mexican side. On the Mexican side of the line, as manager of that corporation, I have had to deal with the offcials in the City of Mexico, who were specially trained in their work. So far as rate-fixing on the American

side was concerned, it was a question of dealing with the board of supervisors of a county, a very small and new county.

The amount of regulation in Mexico is something phenomenal as compared with this country. In America we can build our canals where we please, and put up the sort of structures we please, and do pretty well as we please. In Mexico we dare not put up a structure or dig a canal without the special approval of the Mexican officials. I was very frank in talking to the Mexican officials, giving details of the cost of every structure. The reason I was willing to do that was because I knew that in Mexico I was dealing with a man who knew what he was talking about. I was afraid to give out any information on the American side of the line because the newspapers and the various people who had axes to grind would distort that information and keep me forever explaining, and nothing is so annoying as to explain and explain and explain, over and over, to people who are trying to twist the words you utter into different meanings.

I have heard a number of corporation men say they would rather do business the corporation way in Mexico than in America, and yet in Mexico rates are absolutely fixed for railroads. All railroads at the end of ninety-nine years become the property of the State, without the payment of a cent of money. Time-cards must be approved before they can be put into effect. Books are gone over by government experts, and statements taken from them, and there is a degree of regulation that would make the railroad men in this country wild. But it is accepted in good part, because you are not dealing with the dear people, but with experts, and that is a great difference.

I do not believe that the corporation people in this country are dishonest or are not frank with the people, excepting for the reason that they dare not be frank. They are dealing with people who are not acquainted with the subject, and in Mexico you are dealing with people who are.

Incidentally, with reference to that "going business," the Assistant Secretary of State of Mexico gave me a very good illustration of what he understood by going value. He said: "There have been a number of irrigation enterprises started in Mexico. Many of them have failed. We do not regulate their rates. It is not necessary. Some have succeeded. Those who have succeeded are entitled to a percentage on the risk which they have encountered by going into the business at all." In short he allowed 2 per cent, which is just about equivalent to your 20 per cent of the Wisconsin commission for going business, to allow for the fact that in entering that business at all the man has risked his money by making a failure.

Finally, there is another phase of it. Suppose I go into the dry-goods business today. I may fail. I may make 20 per cent. If I make 20 per cent, there is nobody going to regulate me or to reduce that amount. In other words, there is no limit to the maximum I can make on the business investment in a private corporation, and there is no limit to the minimum. In a public-service corporation, however, the people do not guarantee to the public-service corporation a minimum return on its investment—do not even guarantee that it will come out even. It merely says you cannot make more than a certain amount, and that amount is not very big. It seems to me, therefore, that the "going business" of a public-service corporation is a matter which should be considered as representing that one factor, namely, that while, on the one hand, the public reserves the right to regulate rates to keep the earning capacity down to a reasonable amount, it does not, on the other hand, guarantee anything. In a private business you have no such limits, and you have the same amount of guarantee against failure, namely, none at all.

R. B. Daggett: The subject Mr. Cory has mentioned brings up this point, that the public utility corporation has more or less of a monopoly. Supposing a private individual wants telephone service put in, and he calls up the telephone company, and he gets it put in in a reasonable length of time, that time, he has no redress. Now a private individual, engaged, say, in selling shoes, if he is called up on the telephone and he is told, "I want a certain number of pairs of shoes sent to my place," and they are not sent over in the course of an hour, the man says, "I don't want to do business here, I will do business with somebody else." So the man who goes into private business is entitled to more, if he can make it, because he has no monopoly; but the public utility corporation has that monopoly; it has that hold on the people.

Another point that Mr. Burkett brought up was insurance against depreciation. The corporation that I have been identified with for over thirteen years has been into that subject in many different ways. When it first went into business it was necessary to insure in order to do business at all, and the company tried to charge a sufficient price so that if it did not guess right on the depreciation it still would come out all right. Later, as the business got on its feet, it was found unnecessary to make this insurance in order to do business, and as the apparatus was not operated under the best conditions when its was insured, that insurance business was discontinued. Now the experience of engineers has made it possible, with the data that we have, to make insurance propositions on a very close basis and come out very nearly right; and I presume, with any kind of engineering apparatus it would be possible to do that.

W. H. Seaver: As to the cost of operation, I am not familiar with it from the corporation standpoint, except as to manufacturing—not in regard to the distribution of power, manufacturing of power or anything of that kind. It would seem as though it would be comparatively simple to determine the actual value of a plant—perhaps not comparatively simple, but nevertheless not impossible, to determine the depreciation; but the question of cost of operation, while it can be determined for the past, is one of very great difficulty in trying to determine it for the future. I have known many instances in the cost of manufacturing where the fluctuations have been through such tremendous differences that the variations in selling price could not keep up with them. At times, as business would fall off, the cost would increase to such an extent that even with high prices for the selling value the business would show a loss. At other times, in reducing the price of the product, the costs would be so greatly reduced by increased sales that the profits would be increased tremendously. I know a certain manufacturing concern in Connecticut. They had a certain department that made cheap goods, but hadn't made any money. Finally the proprietor took it into careful consideration. He decided that he would take everything that came for a year, and see what the outcome was. On every order that he took he had a system of estimating costs from time to time. Almost every order that he took showed a loss compared with the figures given by the cost department. At the end of the year he had a record made of the actual expense of the department, and found he had made a handsome profit. Those factors must enter into the cost of the production of power as well as other products; and, possibly with the exception of the telephone business, the greater the business the lower the cost. That is a question that enters into the fixing of rates for the future, and as I look at it, it must be an uncertain quantity, and I should think, from the standpoint of the public-service corporations, it would be a very difficult one to determine.

George C. Holberton: There is one point that Professor Cory brought out that I think is worthy of consideration and to which we should all give some thought, and that is the term "piece-meal construction." I think that is an argument against allowing a rate based solely on the replacement value, because a plant is not replaced, neither is it built in a day, a month, or a year. If you take and set out to build a pole line, you will arrive at a figure very much less than the actual cost, or the cost representing the money actually paid out, due to the fact that pole lines are not built in the way

is very well; but if he has to wait a month, or even some shorter that you would probably estimate them. The town grows gradually. A pole is added here and another pole somewhere else, and it cannot be done on the basis of a figure that an engineer might give in building the whole under one contract. In other words, he could build a mile of pole line a great deal cheaper than it has cost the company to build that particular mile of pole line, because it did not build it that way, but built a few hundred feet at a time.

M. M. Libby: May I add a word about replacement values, it having been my good fortune in the engineering business to have been concerned with some of these things that had to be insured, and to have to operate and take care of insured apparatus, apparatus whose life was guaranteed a certain time. In that time I have seen changes take place in apparatus that was insured for ten or fifteen years, so that the appartus was dumped on the scrap and replaced by other apparatus.

These new terms, such as "going value", have not been sufficiently defined as yet. The whole thing is moving along so fast that we have not language to express our ideas; so when one gentleman speaks of replacement value, and another one of some other feature of this business, we are not always thinking the same thought.

The 20 per cent spoken of in the case of Washington makes me think of a matter that came to my attention recently. I had occasion to wait patiently for an interview, and during the process I overheard the explanations which were made when certain replacements and repairs exceeded the values estimated by the engineers in charge; in other words, matters of small import compared with the valuation of the railroad; but the work had been ordered upon the probable expenditure of a certain sum of money to accomplish a certain result. Invariably the expense exceeded the estimate by 33⅓, 50, 40, and in some cases over 50, per cent, which goes to show that the engineer as yet has not gotten suffcient training to really determine the replacement value. I have had occasion to look over the estimates made by engineers of great repute in which the item of 10 to 20 per cent had to be put in their estimate for items that they could not really determine beforehand, because they knew from work that has already been done, and after men had carefully made estimates, that they could not predict the cost close enough to warrant capitalists in taking hold of it.

I want to bring out the point now, that particular point, that I fear that the term "business man" has been made to include too many of the "common people," and has been given a little bit of a black eye as compared with the engineer. I think we engineers have a great deal before us in the way of estimating, before telling these things for the benefit of those who employ us. The man who made the estimates which overran 33⅓ would not be a very good employee for a contracting concern. It is a vast difference, being employed for a person who is going to have the work done, anyway, and wants your ideas as to what it is going to cost, and being employed by a concern where your estimate determines whether they are going to do business tomorrow and the next day, and have a little profit for their own use. I think if we get in line with the work that is before us, we will be able to call in the business man and explain it to him. My experience has been that the business men who are about to invest money—and those are the men I have classed as business men—men who are dealing in financial matters—as a rule have the engineers up a stump, and there are only a few of the commercial engineers who are really able to do business with the financial men, because the financial men have the best of it most of the time.

Our paper tonight was so brief that almost any of us can get up and take more time in the meeting than the paper itself; but it takes a great deal of thought and effort to find language sufficiently plain and elementary so that it can be applied to the subject and not lead us off into the mystery and maze where we won't accomplish anything. I think the example given to us by Professor Cory warrants further study, and I think it would be better for each of us to give some thought to how the questions raised tonight can be answered in the simple language of the example given in the paper.

C. L. Cory: I will add just one or two words. I want to recur to one point that I made regarding the almost universal necessity of the public-service corporation finding it necessary to dig up probably a lot more money than it earns, because we discussed the matter of trying to educate other people only as applied to the proper return on the investment. Suppose any one of us has the sum of $5,000, and we loan it on a mortgage and get 7 per cent. That is $350. Now let us suppose, in order to hold that loan, we had to dig up every year $700. Is the 7 per cent rate sufficient? Many of you know much better than I how absolutely necessary it is to meet the enormous expense of these extensions. It is a point that has not been discussed generally, but is worthy of serious consideration.

The discussion this evening has, I think, justified the very brief paper. I told you the story about the college graduate and John Hay. I don't need to say any more. I do want to add this, however. The study of these matters is not like the study of Ohms's law, nor can you solve them with the slide-rule. As we found this evening, the very terms we were trying to use, we do not know the exact definition of them. How can we get it? I think the best thing we can do is to get down and study it, everyone of us, perhaps, with one exception, because they are so new. I don't know of any better place to study it than to follow—as has been indicated to us this evening by Mr. Britton—the work of the Massachusetts commission and the Wisconsin commission. Their publications are available *in toto*. I don't suppose those commissions—in fact, I know some members of the Massachusetts Highway Commission themselves did not know the proper definition of those terms we have been discussing. Let us get together and take that up, and perhaps let Ohms's law alone for a little while, and I think we will be a good deal better engineers and better members of society, and of very much better service to those who have the right to look to us for loyal service. We will be a good deal better bunch of engineers than if we stick to those other things exclusively.

JOINT ELECTRICAL BANQUET IN LOS ANGELES.

A joint banquet of the Los Angeles Section of the American Institute of Electrical Engineers and the Rejuvenated Sons of Jove was held at the Hollenbeck Hotel in Los Angeles on March 12, 1910.

F. B. Crocker, professor of electrical engineering at Columbia University College, New York, and past president of the A. I. E. E., gave the members an interesting address on conditions in electrical matters in foreign countries, having just returned from his second trip around the world, the first trip being eleven years ago. Dr. Crocker especially spoke on India, China, Japan, and having visited these same countries on his first trip had an opportunity of studying the growth of this work, which in India and China was very discouraging to the American engineers, on account of their extreme conservatism, a point in which they take considerable pride. The lighting and street railway work is slowly going forward but the telephone was not much used as the natives do not seem to care for this particular branch of the science, especially the long-distance work. In Japan, however, all branches of the electrical industry are booming and they are rapidly developing their hydro-electric plants, mainly on account of the many opportunities offered for development along this line. Dr. Crocker also made a few remarks concerning the inception of the A. I. E. E., having personally been president when the organization was founded. The members thoroughly enjoyed Dr. Crocker's address, and appreciated the opportunity of having him present.

J. A. Lighthipe addressed the meeting on the early days in Thomas A. Edison's laboratory. Mr. Lighthipe went to Menlo Park and became associated with Mr. Edison in 1879 and his remarks were among the most interesting of the

evening. Mr. Lighthipe spoke principally of the early work done on telephone apparatus and Mr. Edison's endeavors to get a loud speaking instrument, but this work was soon given over to the electric light end of the industry, which at that time was just beginning to interest the public. The early work done on incandescent lamps as well as generators and their experience given by one who was on the "spot" at the time to see the development, is a subject of never tiring interest to any one in the electrical fraternity and can only be appreciated by hearing it told in Mr. Lighthipe's inimitable manner. While he exceeded his time limit for speaking, every one present would have gladly stayed all night if he would have been willing to have continued.

E. F. Scattergood, chief electrical engineer of the Los Angeles Aqueduct, chose as his subject "Engineering," a subject that could not possibly have been delivered in a more thorough and satisfactory manner than was given by this gentleman. He spoke of the enormous good that can be obtained by co-operation among engineers and by every member of the profession having his data files open to his brother engineer, likening the profession to medical work where nearly every doctor of standing in the world gladly contributed his findings on a particular subject to the good of the profession in general. Mr. Scattergood stated further that the student of electricity must devote his life to the science and its application more than to the financial remuneration he personally might gain. That Mr. Scattergood's speech was appreciated was demonstrated by the remarks heard after the meeting adjourned and his ideas of co-operation sank into the heart of every man present.

One of the most interesting talks of the evening was that given by O. H. Ensign of the U. S. Reclamation Service. Mr. Ensign took up the work at the very beginning, outlining its scopes, resources and development, treating each subject in a manner so interesting that the writer could not waste a word in an endeavor to take notes, selfish but justified. One cannot appreciate the magnitude of the enormous undertakings of this department by simply reading a report of each project, but must hear it given by so able and easy a talker as is Mr. Ensign. The members can congratulate themselves on the opportunity of hearing Mr. Ensign on this subject, as such opportunities are rare..

In the absence of H. C. Bowers, H. B. Woodill took up the subject of "Contracting" and ably represented that branch of the industry. Mr. Woodill confined his remarks to the early days of the business, being one of the oldest contractors in Los Angeles, describing the methods of installation in those days as compared with the present-day construction. The subject was handled in a competent manner and Mr. Woodill took this occasion to say that the contracting and engineering work should be separate and distinct, inasmuch as very few contractors were capable of doing engineering work, but rather than lose a contract most of them would attempt work that naturally reflected discredit on the engineer's profession when the result of such an attempt proved unsatisfactory.

E. R. Northmore presented a paper on the lighting companies, covering the electrical work in Los Angeles from the beginning to the present day, also the benefits to be gained by joint pole construction. The paper is printed elsewhere in this number, and is interesting to those familiar with the rapid development of electrical matters in this territory. Mr. Northmore began work on the first plant in Los Angeles and, staying with the same company to the present day, certainly can be conceded authority on the subject presented and the early day work, when he read all the meters, "shot" all trouble and generally took care of all outside work in the city, makes interesting and amusing history, of which Mr. Northmore can well be proud.

C. W. Koiner presented a most interesting paper on the aims of the A. I. E. E. and the growth of the local section. This paper is also printed elsewhere in this number and is well worth reading, not only by Institute members but by non-members, as it carefully details the work laid out by the directors of the Institute, and the standing of its members and associates. The figures given by Mr. Koiner were carefully obtained and are as accurate as can be compiled and the members are deeply indebted to Mr. Koiner for the time he put in, in getting this before them.

A. W. Ballard closed the meeting with a short address on the Rejuvenated Sons of Jove, who they are and what part they take in the electrical field. Their chief object is to boost everything electrical, consequently is a worthy cause and a subject for serious consideration by every one in any branch of the business. The local organization started about 18 months ago with four members and has a present membership of about 40. Mr. Ballard stated further the Sons of Jove were really the social end of the A. I. E. E. and hoped to see all of the members soon "ride the goat" in the Sons of Jove and would personally see that they got their money's worth.

NEW CATALOGUES.

"Northern" Type B direct current motors are interestingly described in Bulletin 1119 from the Fort Wayne Electric Works.

The Cutler-Hammer Manufacturing Company are distributing a folder showing their lifting magnets in construction and in use.

Bulletin 1118 from the Fort Wayne Electric Works illustrates and describes the construction, design and operation of their Type A constant potential transformer.

Barrett jacks are illustrated and described in catalogue No. 109B from Fairbanks, Morse & Co. This includes all forms of lifting jacks specially adapted for railway work.

Ad Book No. 13 from the Westinghouse Bureau of Publicity contains examples of a number of excellent newspaper advertisements for central stations. This number is devoted to "moving day."

The Duplex Metals Company of New York has issued in pamphlet form an attractive advertisement on standard specifications for hard-drawn, copper-clad steel wire and copper-clad steel bond wires.

The February number of "Hot Points" from the Pacific Electric Heating Company of Ontario, Cal., is known as the catalogue issue and contains illustrated descriptions of the various heating devices manufactured by the company.

Fairbanks, Morse & Co. of Chicago, Ill., have just issued their new Catalogue No. 113, which fully describes and illustrates their 1910 line of two-cycle marine engines. The four-cycle heavy duty Fairbanks-Morse marine engines are fully described and illustrated in Catalogue No. 112B, which is very attractive and which contains complete information covering this line.

The General Electric Company has just issued a pamphlet, No. 3894, on the subject of Building Lighting, which should be not only of interest but of service to managers of hotels, apartment houses, and all large buildings of either a public or private nature. This pamphlet contains references to a number of important installations of lamps having tantalum and tungsten filaments.

The Harvard Electric Company of Chicago and New York City have issued a new catalogue known as No. 20, which is descriptive of a part of the many electrical necessities made by the Harvard Company. In this bulletin, which relates chiefly to Harvard patent galvanized channel steel brackets, sectional switch boxes, conduit boxes, fuse wire, fuse strip, open fuse links, Harvard bevel edge self-welding wire joints, fuse blocks and telephone fuses, test connectors, cable hangers, etc., etc., there is given a detailed description of the various Harvard specialties, dimensions, etc.

THE LIGHTING COMPANIES OF LOS ANGELES.

BY E. R. NORTHMORE.[1]

Los Angeles, in the electric business, as in everything else, is always among the first. One of the first plants for furnishing street lighting was installed in this city about twenty-seven years ago. At this time Los Angeles was a small town of 13,000 inhabitants and the lighting was distributed by six masts, 150 feet high, at the following locations: S. P. River Station; Commercial and Main; First and Central; Sixth and Main; First and Boyle, and Avenue 24 and Downey. These masts were first installed in conjunction with enough arcs at street corners and in stores to make a load of 50 arcs, or enough for one Brush arc machine.

As the town grew to be a city, commercial lights were gradually installed in the business district, so that in 1893, or 10 years after the plant was installed, the entire output of the only electric plant had grown to the enormous load of 250 street arcs (moonlight schedule), 250 commercial arcs and 2000 16-c.p. flat rate incandescent lamps, all commercial lights being turned out at midnight. You want to remember that in these early days, the city did not grow as fast as it does now.

In the year 1896 another lighting company commenced operation in this city with a small steam plant of about 500 kw. capacity, at Second and Beaudry streets, working in conjunction with a water power plant and high tension line from Santa Ana Canon.

In 1898 another plant commenced operation at Third and Los Angeles streets, with a capacity of 300 kw., and they also brought in about 400 kw. high tension current from the San Gabriel River. Again Los Angeles was the pioneer, as these were the first succeccful high tension lines in the world.

In 1897 the city created the first conduit district, ordering all the poles and wires from the streets and alleys in the district bounded by Seventh, Los Angeles, Massachusetts, New High, Temple and Hill streets. One of the lighting companies installed the original Edison tubes, one used paper fibre conduit incased in concrete, and the other used redwood planks with grooves cut in them. The only conduit which has held up to date is the paper fibre conduit incased in concrete.

At this time the center of the load was at First and Spring, and all the companies ran very light cables south of Fourth street, as they all decided that there was not enough business to warrant pulling in heavy cables.

One of the most important changes introduced recently and one that has been promoted primarily in the interests of the lighting companies, is the Joint Pole proposition. This was originally planned by the lighting and railway companies in Los Angeles, but the scheme has spread so as to include many of the telephone companies in Southern California, and in three years of operation it has developed into one of the most important lines of activity.

In this city alone, over 15,000 poles have been eliminated in three years, and five years more is going to see practically all overhead construction work in this city on common pole lines. Construction is done under rigid specifications, making it safer, better and cheaper, and, in addition to this, the public have been satisfied. Formerly it was often a very delicate matter to undertake setting a pole in a location where three or four "sticks" already walled in the perspective. We have had cases where angry property owners have camped in a half-dug hole, for the purpose of obstructing and preventing the completion of the work, and yet we were acting only within our franchise rights in furnishing the particular service demanded of our companies.

I mention this work simply to show what may be done by co-operation. Competition may be as keen as ever with us, but when it comes to satisfying a public demand and getting the most for the least expenditure of time and worry, the use of joint poles is to be considered an important factor.

The committee furnished records of all combinations, and that in itself is an important item, introducing a standard method of mapping the pole plant of the various companies. I have on file in my office over 2000 blueprints, each indexed carefully according to street locations and cross indexed with cards according to owners, and all we have had to do with these is to file them as furnished month by month—and incidentally pay our proportion of the expense of the committee.

The Joint Pole Committee is composed of a representative from each of the lighting, railway and telephone companies, who in the beginning appointed as secretary, Mr. J. E. MacDonald, who is handling this work in a very competent manner.

The companies are heartily in favor of the American Institute of Electrical Engineers and Sons of Jove and are its best boosters. There are 67 members, or 60 per cent. of the total membership of the local section of this institute who have been or are at present employed by the companies, and by looking over the list of members we find men of world-wide reputation, who stand among the highest in the electrical fraternity, and the majority of these have at some time been connected with and received some of their best training from the companies, and I feel sure that there is just as good "timber" in the younger element, and I believe that the lighting companies are giving them a show and boosting them wherever possible.

[1]Paper read at joint banquet A. I. E. E. and Sons of Jove, Los Angeles, Cal., March 12, 1910.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.[1]

BY C. W. KOINER.

The American Institute of Electrical Engineers is the national society of the electrical profession, and was founded 26 years ago at just about the beginning of the electrical industry. Its growth has kept pace with that of the electrical industry which is without a parallel. To measure the growth and the importance of the Institute it is necessary to consider the tremendous growth of the electrical industry.

The first telephone exchange was not installed until 1878 and there are at the present time 5,500,000 telephones in use in the United States alone. The first central station was installed in 1882, and at this time

[1]Paper read at joint banquet A. I. E. E. and Sons of Jove, Los Angeles, Cal., March 12, 1910.

there are 6,000 stations, not including the many more numerous isolated plants. These central stations have an income of $250,000,000 a year, and develop 2,250,000 h. p.

The first electric railway in this country was installed in 1888, and there are now in operation 90,000 cars on 40,000 miles of track, with earnings of $475,000,000 per annum.

It is estimated that the investment in the various electrical industries is $6,000,000,000, and this industry has been developed within the last 30 years. It represents approximately half the value of all our American farms.

The electrical industry has grown to a point where the amount of business transacted per annum amounts to one and one-half billions of dollars. The estimates and statistics compiled by the "Electrical World" for the year 1909 shows that the value of manufactures, machinery, etc., amounts to two and three-quarter millions of dollars. The earnings of electric railways amount to $475,000,000; of central telephone stations $250,000,000; of telegraph stations $60,000,000; of isolated plants $75,000,000; and miscellaneons $50,000,000.

The institute has played a very important part in this stupendous development and its membership is directing all of the great variety of electrical industries. From the few members at the time of organization the institute has grown until it now has 6,000 associates and 500 members and is the largest of the engineering societies. All branches of engineering are represented in the membership and its members are scattered all over the world. While this is our national society, its members are called to all parts of the globe, in the capacity of constructing, operating, and managing engineers.

The importance of becoming a member of the institute should be impresed upon all electrical engineers. It enables them to keep abreast with modern engineering practices through the institute papers and discussions. The papers represent the very best information that is to be had and are written and discussed by the very brightest men in the profession.

All young engineers should become identified with the society which has helped to make electrical engineering what it is and which has made the path easier for the younger engineers, and for those who are interested in the advancement of the electrical science.

We are deeply indebted to the men who founded this society, to those who foresaw the advantages of an organization of this character. The engineer owes it to himself as well as to the institute to become affiliated with the recognized electrical engineering society of his country. He can be inspired by no better object than that of the institute which bears repeating here.

"Its object shall be the advancement of the theory and practice of electrical engineering, and of the allied arts and sciences, and the maintenance of a high professional standard among its members."

Special emphasis must be put upon the objects quoted here. An engineer whose code of ethics is not in keeping with the high standard of the institute has no place in this society.

The institute will continue to grow in numbers and importance. The application of electricity for power purposes in all lines of industry necessarily requires a large number of engineers. Hence the institute is destined to become a very large engineering body. Because the society will necessarily be large in numbers does not mean that the standard or quality of its membership will be lowered in the least.

The government of the institute is vested in a president, six vice-presidents, twelve managers, a secretary, and a treasurer. These officers are supplemented by a necessarily large number of committees numbering 19 or 20.

As you are aware the institute owns an interest in the Engineering Building, which is a partial gift of Mr. Andrew Carnegie. Last summer while in New York I had the pleasure of being shown through the building for the first time. This building is a model of its kind, having been primarily designed for the three engineering societies that occupy it. It is located on West Thirty-ninth street and is easily reached by car lines radiating to all parts of the city.

The library is located on the two upper floors. It is composed of the scientific works of the three societies which occupy the building. It is of course one of the greatest and most useful parts of this engineering home. Our institute alone has 18,828 volumes in its library.

It may be interesting to note that the assets of the institute is about $670,000.

One of the many good things which the institute has accomplished was the introduction of standardization rules. A committee was appointed and continued until these rules were evolved and adopted. And they are such that we could hardly dispense with them.

The institute is necessarily represented in the various large centers of business by sections and branches. These sections and branches enable the members to meet together for discussion of the papers presented in New York, or for papers that may be written by its local members. There are now in existence 25 sections and 27 branches.

It is fresh in your minds how 19 or 20 months ago we of Los Angeles came together and decided that we would organize a section. Much enthusiasm was manifested at the time and I am happy to say that it has not abated. We began with about 25 members, and today I believe we have 100 additional members. Los Angeles section, though one of the youngest, is ninth in point of members. You are to be congratulated on your diligence in building up your membership.

Los Angeles section exceeds all other sections in growth for the last year. We are the largest west of Chicago with one exception, San Francisco only exceeding us. The chairman of our membership committee is now planning to do some very effective work towards increasing the membership. And this is to be done without lowering the standard or the quality of our membership. I sincerely trust and believe that our section will continue to have a healthy growth and will grow in influence and usefulness to its members.

We must not forget we will be able to extract only in proportion to our in-put; that is to say, only as we work for our section will we be able to enjoy its benefits to their fullest extent.

THE WATT-HOUR METER.

BY WM. M. SHEPARD AND ALLEN G. JONES.

CHAPTER III.

(Continued.)

Polyphase Meters.

The polyphase induction watt-hour meter for use on either a two or three phase system consists essentially of two single phase meter elements mounted one above the other on the same shaft, and having but one register. The principle of operation is identically the same as that previously explained for two single phase meters, except that in the case of the two single phase meters, the algebraic sum of the two registers is taken to obtain the total power, while in the case of the polyphase meter this is automatically accomplished by having the two discs connected to one shaft. The polyphase meter has the advantage of being easy to read and install.

The polyphase meter for use on three phase four wire systems when used without current transformers is of somewhat different construction from the meter used on three phase three wire, or on two phase systems. In the three phase four wire meter without current transformers, it is necessary to have a current winding in the meter for each phase. These windings are arranged on the two elements in such a manner that the current in one phase passes through a winding on each element; the current in each of the other two phases passing through a winding on one

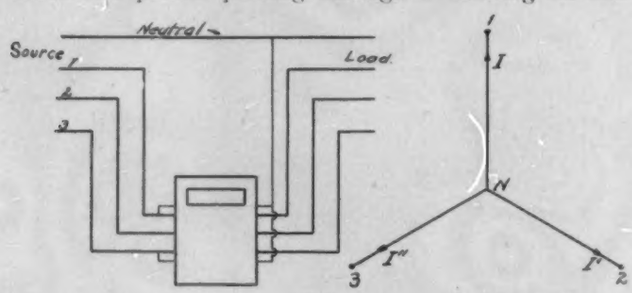


Fig. 40.

element. Fig. 40 shows the vector diagram and also the diagram of connections of this type of meter, in which I, I′ and I″ represent the currents in phases 1, 2 and 3 respectively, and 1-n, 2-n and 3-n represent the voltages between the legs 1, 2 and 3 and the neutral wire, n. One element of the meter has the voltage 3-n impressed upon its potential winding, and the current I″ passing through one set of current coils, and the current I′ passing through the other set of current coils. The other element has the voltage 1-n impressed upon its potential winding, and the current, I passing through one set of current coils, and the current I′ passing through the other set.

A three phase four wire system is, in effect, three single phase systems, the current in each system being the current in the corresponding phase, and the voltage of each system being the voltage between the corresponding phase and the neutral.

With the connections described above, the power being transmitted by each of the two single phase systems, 3-n and 1-n will be correctly recorded by the meter for both unity power factor and for power factors other than unity, as each element of the meter will act as a single phase meter in recording this power. The power being transmitted by single phase, 2-n will be recorded partly by one meter element and partly by the other. The current I′ passes through both meter elements, the connections to its coils being reversed so that for unity power factor it is 60° out of phase with the voltage impressed on each element. (If these coils are not reversed the current, I′ will pass through the meter 120° out of phase with the voltages impressed on the two elements and will subtract instead of adding the power in phase 2-n.)

Since the cosine of $60° = 1/2$, one-half of the power will be recorded by each element. For power factors other than unity, one element will record more than half, and the other element will record less than half the power being transmitted; the sum of the power recorded by both elements will be equal to the total power.

When current transformers are used with three phase four wire meters, the standard polyphase meter as used on three phase three wire circuits may be used, the current transformers being so connected that the resultant current of phases 3 and 2 passes through the current coils of one element, the voltage, 3-n being impressed on this element; the resultant current of phases 1 and 2 passes through the current coil of the other element which has the voltage 1-n impressed upon it.

The action of this type of meter is the same as just described for the meter without current transformers. In the latter case, two sets of current coils are used on each meter element, the resultant effect of the currents in these two sets of coils being the same as the resultant of the currents from two current transformers passing through one set of current coils.

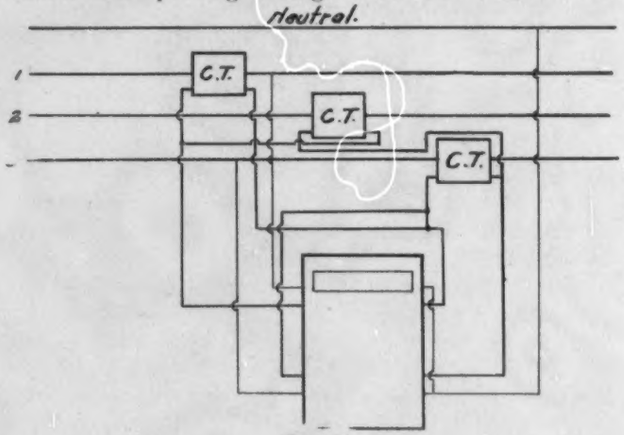


Fig. 41.

Fig. 41 shows the proper connections for a polyphase meter when used on a three phase four wire system in conjunction with current transformers.

Adjustment of Elements.

Polyphase meters should be provided with some means of adjusting the torque of one of the elements without disturbing the other. This is necessary because there is only one retarding system which is common to both elements, and it is therefore necessary that some means be provided so that the two electrical elements may be adjusted to give the same torque when the same amount of power is passing through each. This adjustment is readily accomplished by changing the number of turns on the potential winding of one of the elements. By this means, the torque of that particular element can be adjusted to be the

same as that of the other element. This is done in some meters by bringing out a number of taps from the potential winding, having a very few number of turns between taps, so that a fine adjustment can be accomplished.

Other meters employ what is known as a "balance loop," which is a short-circuited turn whose position can be so changed that it will introduce more or less reluctance in the path of that portion of the flux from the potential winding which does not pass through the meter disc. Increasing this reluctance will cause more of the flux to pass through the meter disc, while decreasing it will cause less flux to pass through the disc. After adjusting the "balance loop" the meter should be "re-lagged."

The balance between the elements of a polyphase meter can also be altered by changing the air gap between the potential and the current coil poles of one element; this can be accomplished by loosening the screws and prying the poles further apart or by using a light wooden mallet to drive them closer together. The adjustment obtained by this means is necessarily very rough, but it is sometimes useful (usually when putting a new potential coil in place) to bring the elements within the range of adjustment provided by the manufacturer.

Interference of Elements.

Polyphase meters are subject to one source of error from which two single phase meters used on polyphase circuits are entirely free, that being the "interference of elements," which is due to the interference or reaction of the magnetic fields of one element with the fields of the other, and in some cases it introduces errors amounting to as much as 4% or 5%. For this reason the elements should not be placed too close together. In a well designed meter operating near unity power factor, the error from this source should never amount to more than 0.5%.

Polyphase Meters on Six Phase Circuits.

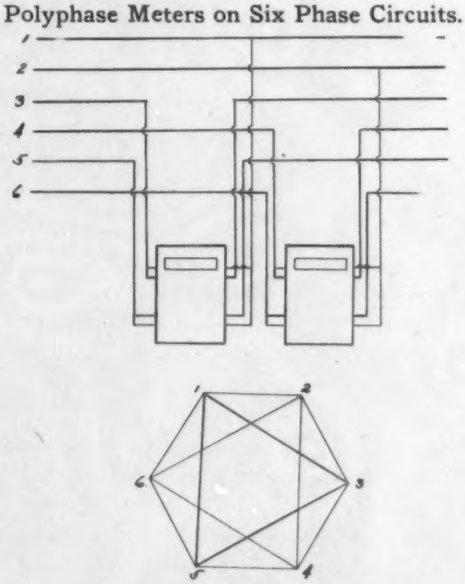


Fig. 42.

Fig. 42 shows the proper connections of two polyphase meters when used to measure the power flowing in a six phase system.

Metering High Potential Circuits.

When meters are used on high potential circuits, the secondaries of both the potential and the current transformers should be solidly grounded. This is not only a precaution for the safety of those who have to read and test the meter, but it also prevents undue strain between the windings of the meter. Both the potential and the current transformers act as condensers, and so do the windings of the meter themselves. The voltage of the system is thus impressed across several condensers in series, the strain across each condenser being inversely proportional to its electro-static capacity. It is possible for the strain thus impressed to reach a value which will puncture the insulation from the winding to the core.

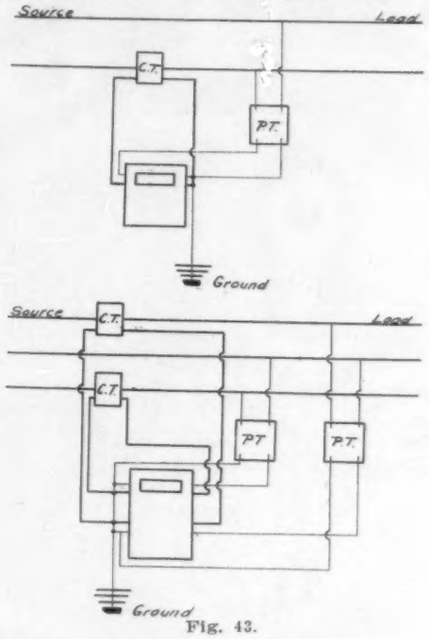


Fig. 43.

Fig. 43 shows the connections for both a single and a polyphase meter when used with current and potential transformers, showing the ground connection to be made when used on high potential circuits.

When metering the high tension side of a "Y" connected three phase system, the current transformers can be relieved of a great part of the high tension strain by connecting them between the power transformers and the neutral or "Y" point. This will also protect the current transformers from lightning and high potential surges, as each current transformer will have a power transformer between itself and the line.

Current and potential transformers used with watt-hour meters should never be operated under the condition of overloads, and it is best to have them operate considerably underloaded. Overloading the transformers will cause the meters to run slow.

Current transformers are usually rated at so many watts, for instance, 40 watts. The sum of the volt-amperes taken by all the meter coils in series with such a transformer plus the volt-amperes consumed in the leads to the meters should never exceed this amount and should preferably be less.

Potential transformers are usually rated at from 10 to 200 watts. The total load in volt-amperes should never exceed the rating and where a high degree of accuracy is required the total load should be considerably less than the rating.

(To be continued.)

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Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval. Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal." July 1895.
Entry changed to "The Journal of Electricity." September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas." August 15, 1899.
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PACIFIC COAST ELECTRICAL EXPOSITION.

The management of the Pacific Coast Electrical Exposition announces that it will be opened on May 21, 1910, at the new Coliseum in San Francisco. More than enough space has already been taken to assure the success of the show, which has been delayed because of the burning of the Coliseum last winter.

New Work for The Engineer

Foremost among the many new conditions to which we are all necessarily adapting ourselves in this present plastic period are those which have arisen in connection with the supply of certain conveniences to communities. These modern conveniences include transportation, power, light and telephone service which can be developed and furnished most economically by that combination of capital known as a corporation. But because some of these corporations in the past have sometimes been too militant in the strife of competition there has been spawned a feeling of class hatred which loses sight of the fact that civilization is successful only when synonymous with mutual service.

If this widespread prejudice against corporate supply of public utilities continues unchecked, the most radical among the dissatisfied will attempt to substitute a more popular means of supply. As we are yet some centuries short of the millennium, and as our present government is not properly equipped to carry on this kind of work, wise men see impending evils in such a change that are even greater than those that now exist. We desire to hold no brief for the corporation which, under the old policy of "the public be damned." has brought dire calamity upon itself, but we ask at least a fair hearing for other corporations who are willing to give full publicity about all their doings. Most corporations are now willing to do this and more, but find that their good intentions are frequently rudely rebuffed. In time, of course, a good feeling can be established by such means as public service commissions, but this action can be greatly accelerated by a slight effort on the part of the engineer.

The engineer is peculiarly qualified by his training and knowledge to act as a peace-maker between these contending interests. It is he who can best inaugurate a campaign of education, which may well be likened to the propaganda of that great religion which also has as its basis the idea of fellow service and which grows only by mutual co-operation. There are definitions to be made and creeds to be formulated which require the expert attention of the engineer who has made possible the utilization of these natural forces for the needs of man. The average engineer has been too much of a hermit and has not taken advantage of the fact that his word as an unbiased worker is given credence where that of the men financially interested in a project is not. He should, therefore, feel called to go out as a missionary, and "preach the gospel of fairness to capital invested." He can, by so doing, add his quota of service by which the full measure of success is to be ultimately reckoned. In acquiring his education, the engineer early learned that there was far more in college than books, and in the practice of his profession he should realize that there is likewise far more in engineering than the slide rule. By removing distrust he is preparing the foundations of a structure more lasting than one built of stone and steel.

PERSONALS.

William Goodwin of the Pacific States Electric Company of San Francisco is in New York City.

Leon M. Hall of Hall, Demarest & Co. has been making an engineering investigation near Cloverdale, Cal.

S. N. Griffith, who was one of the promoters of the Fresno Traction Company, is in San Francisco from Fresno.

Leon Bly, secretary of the Butte and Tehama Power Company of Red Bluff, was a recent visitor to San Francisco.

Robert T. Reid, superintendent of the Western Union Telegraph Company in Seattle, Wash., was in San Francisco during the past week.

S. M. Stone, an engineer associated with Hall, Demarest & Co., with headquarters at Virginia City, was in San Francisco during the past week.

F. S. Kenfield, president of the Kenfield-Leach Company, publishers of "Telephony" and other technical periodicals, was a recent visitor to San Francisco.

L. A. Somers, of the industrial and power department of the Westinghouse Electric and Manufacturing Co.'s San Francisco office, is in Bakersfield, Cal.

F. G. Cary, who is interested in electric lighting and water power enterprises, arrived from Lodi last week and remained in San Francisco a short time.

Thomas Collins of the Westinghouse Electric and Manufacturing Company's sales department, is again at his desk in the San Francisco office after a severe illness.

L. H. Conklin has resigned as general manager of the Scranton Electric Company of Scranton, Pa., to become engineer of the operating department of J. G. White & Co. of New York.

Julian Thornley of New York, who recently assumed charge of the construction of the Great Western Power Company's large dam at Big Bend, visited the company's San Francisco office during the past week.

A. C. Sprout has returned from Keeler, Cal., where he went on engineering business for the Four Metals Mining Company, which is developing water power for electric power transmission purposes on Lone Pine creek.

W. E. Warren has purchased the stock of electrical fixtures and supplies of the Smith Electric Company of Blaine, Wash., and has moved his stock from the location on Martin street to the store on Washington avenue.

Francis Hodgkinson, the head of the Westinghouse Machine Company's steam turbine department, left San Francisco this week for a tour of Southern California, accompanied by K. G. Dunn, of Hunt, Mirk & Co.

Clem A. Copeland has resigned as electrical engineer for the Pacific Electric Railway Co. of Los Angeles, Cal., to join the department of operation and maintenance of the Pacific Gas and Electric Co. of San Francisco.

Wynn Meredith, manager of the San Francisco office of Sanderson & Porter, has returned from a trip to New York. He visited Victoria, B. C., where his firm has important work in progress, before going East, and spent a few days in Los Angeles on his way home. He also visited the Pacific Electric Heating Company's large and growing manufacturing plant at Ontario, Cal., while in the southern part of the State.

C. L. Cory, consulting engineer, has returned from a trip to Santa Barbara and Los Angeles. He has been engaged by the city of Santa Barbara to determine upon the proper valuation of the Santa Barbara Gas and Electric Company's plant for the purpose of fixing rates. He secured the necessary data from the local company and the Edison Electric Company of Los Angeles, which is the holding corporation.

W. W. Briggs, Jovian Statesman for Northern California has appointed the following committees: Entertainment—F. H. Poss, A. E. Drendell, F. S. Fowden, and W. S. Hanbridge; membership—W. L. Goodwin, O. B. Gregory, F. D. Fagan, H. D. Boschken; finance—C. G. Hillis, W. S. Berry, T. E. Bibbins, R. D. Holabird. The chairman of each of these committees together with Mr. Briggs are to form a welfare committee.

TRADE NOTES.

The General Electric Company has sold to the Schwager-Nettleton Mills, in Seattle, Wash., two A, T, B, 2, 500-kw., 3,600 r.p.m., 480-v., horizontal, condensing Curtis turbine generator sets.

The St. Louis offices of the contract agent of the Electric Storage Battery Company of Philadelphia, which are now located in the Wainwright building, will be moved on Monday, March 28, 1910, to No. 1205-6-7 Fullerton building, Seventh and Pine streets, St. Louis. Bell Telephone No. Main 2728, Kinlock Telephone No. Central 921.

A contract has been closed for the stranded aluminum wire for the new 40-mile electric transmission line for the Jordan river development of the British Columbia Electric Railway Company on Vancouver Island, near Victoria, B. C. The total length of the wire ordered is about 120 miles. Sanderson & Porter are the engineers, Wynn Meredith being in charge of the work on the Coast. The above order was placed through the Seattle office of Pierson, Roeding & Co.

Jack MacGovern, of MacGovern, Archer & Co., of New York, left San Francisco last week for the East. His firm purchased from the United Railroads six 25-cycle rotary transformers, ranging from 1,000 to 1,650 kw., and six large static transformers. In changing over to the Stanislaus River transmission plant as a source of supply it was found necessary to use 60-cycle current. General Electric motor generators are now being installed in the railroad sub-stations in San Francisco.

Announcement has been officially made that the Electric Storage Battery Company of Philadelphia has acquired all the patents and rights of the Westinghouse Storage Battery Company. The Westinghouse Storage Battery Company owned all the rights of the General Storage Battery Company, and the storage battery interests and patents of the Westinghouse Machine Company. From this time on the Electric Storage Battery Company will have the sole right to manufacture Westinghouse batteries.

On May first the Dearborn Drug & Chemical Works will move their general offices and chemical laboratories from the Postal Telegraph Building, where they have been located since the organization of the company more than twenty years ago, to the new McCormick Building, on Michigan avenue and Van Buren street, Chicago. The extensive growth of the business of the company has made necessary this removal to its new home, where the general offices and laboratories will occupy the greater portion of the top floor of one of the finest office buildings in Chicago. The Dearborn Company will have the entire frontage on Michigan avenue for its offices and laboratories, with a total floor space of more than five thousand square feet.

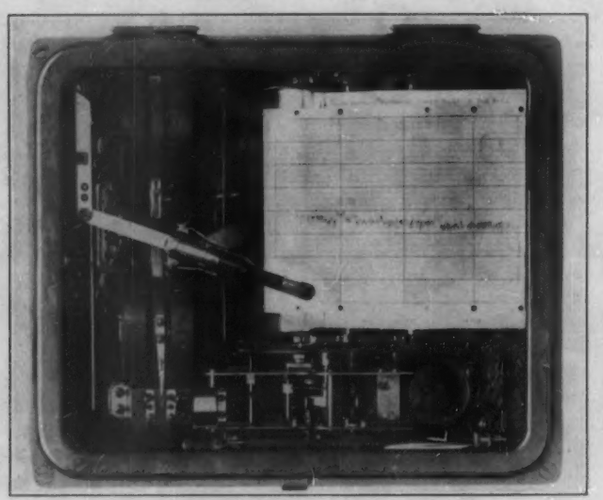
The American Electric Fuse Company of Muskegon, Mich., has just received news of a decision in its favor, filed February 14, 1910, in United States Circuit Court, for the southern district of New York, upon patent No. 521,018, covering double tubed connectors for telephone and telegraph wires. This suit has been pending about six years. Testimony has been taken in a large number of different cities. The subject matter involved was what is known as the American improved double tube connector for splicing telephone and telegraph wires. This connector has been manufactured by the American Electric Fuse Company for the past ten years, and under the decision just rendered in United States Circuit Court, the rights of the American Electric Fuse Company are fully confirmed in all respects.

INDUSTRIAL

RECORDING THE OUTPUT AND LOAD FACTOR OF NEWSPAPER PRESSES ELECTRICALLY.

Among the interesting special applications of graphic recording electrical instruments is their use as speed recorders where some important, continued operation is to be studied with a view to improving its time, efficiency and economy. Several large New York daily papers have had installations of this kind added to their press-room equipments, and are now obtaining complete, continuous records of the operation of their mechanical plants—information which is found very valuable in foreseeing delays and halts during the hurried and important minutes when each paper is racing to be first on the streets with its edition.

Ten-volt magnetos have been used in these instances, being geared or positively connected to the main shafts of the respective presses. When run at full speed, say 250 revolutions per minute, such a magneto is designed to give



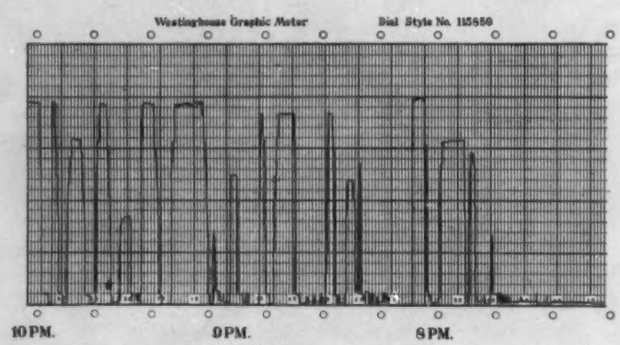
Graphic Speed Recorder.

ten volts at its terminals. Arranged to be connected across these terminals is a ten-volt Westinghouse graphic recording voltmeter, which gives a full scale movement when ten volts is impressed upon its windings. Special record paper is furnished, reading directly in revolutions per minute up to 250 for a full scale deflection. It is evident, therefore, that when the magneto is running at full speed, 250 revolutions per minute, it develops ten volts, and this in turn produces a full scale indication, which is read directly from the scale as 250 revolutions per minute. Intermediate speeds are proportionately and accurately indicated.

At the present time one of the best installations of this system is in the printing plant of the New York World, which has sixteen magnetos for recording the speeds of its single and double octuple presses. Each single octuple press is provided with one magneto and each double press with two magnetos, as the two parts can be operated separately. At present there is installed in the World office, in a room two floors above the press-room, a single Westinghouse graphic speed indicator arranged for connection at different times to any of the sixteen pairs of leads from the corresponding magnetos.

Each magneto has an individual complete metallic circuit to the graphic speed indicator; each circuit including a separate voltmeter resistance which has been accurately adjusted to correct the differences in the resistances of the leads, voltages of the magnetos, etc. The lengths of the various pairs of connecting wires vary from 150 to 250 feet, and the voltages of the sixteen magnetos are all within 10 per cent at the same speed. However, the accurate allowance made for each factor by inserting suitable resistance, followed by careful calibration of the indicator in circuit with each magneto, makes the meter reading absolutely dependable for the speed of any of the sixteen presses. To avoid the trouble of changing over connections, and to obtain records of several presses at the same time, each magneto is later to be furnished with its own permanent recording instrument, although this was not done at first in the case of the World on account of the rather novel and experimental nature of the installation.

In the case of the World plant, the full load speed of the press cylinders is about 200 r.p.m., and as the magnetos are designed to operate at a maximum of 1,000 r.p.m., they are geared to the press cylinders at a ratio of 4 to 1 by means of sprockets and chains. When the press is operated at a speed of 200 r.p.m. the magneto is running at 800 r.p.m., and the meter records at a point four-fifths of the distance from zero to the top of the chart.



Graphic Record of Printing Press.

The meter clock is provided with a synchronizing attachment which is controlled from the master clock connected to the Western Union service through a special relay. The master clock is controlled by impulses at one-half minute intervals from the Western Union service, and it in turn controls a large number of clocks installed through the Pulitzer building, in which the World plant is located. The relay is required to give impulses at intervals of one hour for the synchronizing device.

Accompanying is the reproduction of a record recently obtained on a large press in the New York World plant during the printing of an edition. The record speed is four inches per hour, and the irregular line produced by the pen indicates clearly the different operations to one familiar with the action of newspaper presses. For instance, the jogs in the record, indicating a speed of about 10 r.p.m. are caused by threading in a new roll of paper in the press, or by the repairing of a break in the paper due to a choke or excessive tension on the roll from which the paper is fed.

As the result of the success experienced with Westinghouse graphic speed indicators in a number of printing establishments, as well as in an experimental installation in its own plant, the New York Globe and Commercial Advertiser is now putting in a complete system of speed recorders in its press-room.

NEWS NOTES

FINANCIAL.

FREEWATER, ORE.—The City Council has instructed Recorder G. P. Sanderson to call for bids for bonds for the construction of the new waterworks system. The bonds are for $16,000, to run for 16 years with interest at 5%.

OREGON CITY, ORE.—At a recent meeting of the water commission it was decided to install another filter unit to the waterworks which will cost $4,000. The unit to be added has a capacity of 500,000 gallons a day and will increase the capacity to 2,000,000 gallons.

TACOMA, WASH.—Commissioner of Public Works H. J. McGregor has awarded a contract to Bertelson & Sons for the laying of water mains on Canal, River and Twenty-first streets for a bid of $25,800. Bids were also received for laying water mains on East L street, East N street and Portland avenue from South Twenty-fifth to South Twenty-sixth streets, from East L street to Portland avenue. Galluci & De Rose were the lowest bidders, but Commissioner McGregor wished to make an investigation as to the water hydrants to be used before awarding the contract.

INCORPORATIONS.

INDEPENDENCE, CAL.—The Home Telephone Company of Independence, with a capital stock of $14,600, has been incorporated by J. S. Bohannon, J. L. Hanna and W. L. Bica.

SAN FRANCISCO.—The General Electric Construction Company, with a capital stock of $25,000, has been incorporated by G. F. and J. H. Belden and G. A. Sittman, with their principal office in San Francisco.

MODESTO, CAL.—The Tuolumne River Power and Irrigation Company, capital stock $50,000, shares $1 each, has been incorporated by D. A. Jones and G. W. Barnett of San Francisco and C. W. Terry, T. F. McGovern and C. H. Segerstrom of Sonora.

SAN FRANCISCO.—Articles of incorporation were filed with the County Clerk of the Water Supply Company of San Francisco. It is to run for 50 years and has $20,000,000 of capital stock. Of this amount, the seven incorporators each subscribe $100, making the total cash subscribed and paid in $700. Most of the incorporators are clerks, bookkeepers and young attorneys in the office of Lawyer McCutchen, Spring Valley's attorney. Their names are as follows: F. E. Boland, R. H. Kimball, T. A. Allan, J. F. Cassell, H. L. Atkinson, R. A. Wagener, all of this city, and F. H. Markey of Alameda. As set forth in the articles, the purpose of the company is to conduct a general water and water power business. Mr. Bourn refuses to either affirm or deny that he personally or as president of and a director and stockholder in Spring Valley, has any connection with the new concern. When pressed to make some statement in connection with the Water Supply Company he replied: "It is impossible for me to talk at this time."

TRANSMISSION.

DIXON, CAL.—E. D. N. Lehe bid the sum of $50 for a franchise to erect poles for an electric lighting and power system. He was awarded the franchise.

TACOMA, WASH.—Morton Ramsdell, manager of the Seattle-Tacoma Power Company, has announced that the company will spend $500,000 in adding equipments (to generate 10,000 additional horsepower) to its Snoqualmie Falls plant.

LOS ANGELES, CAL.—The Board of Supervisors are receiving sealed bids for a 30-year franchise to construct an electric pole and wire system upon certain public highways in this county.

LOS ANGELES, CAL.—Work on laying the third rail of the Pacific Electric's Glendale line on West Sixth Street is held up to await the arrival of material from the East, and it may be a month before work will be done.

SANTA FE, N. M.—An application for the Rio la Casa power plant has been filed in the office of the Territorial engineer. The applicants are J. J. Laubach, W. G. Benjamin, W. B. Bunker and William Harper. The plant is expected to develop 2,745 horsepower and will be about 40 miles from Las Vegas, on Rio la Casa.

LOS ANGELES, CAL.—A corporation known as the Ramona Power Co. has filed on the right to develop electrical power from the water flowing over the Hemet dam. They will build a new dam on the north fork of San Jacinto river. Men behind the power company state that they will develop electricity in the small towns of Hemet Valley. Associated with the power company are Ehrman Grigsby, Roy Jones of Santa Monica, R. M. Miller, MacPherson of Edison Electric Company, and Ben Hunter, an attorney.

BURBANK, WASH.—The Burbank Power and Water Company, which controls a large water power development on the Snake river at Five Mile rapids, has recently ordered from the Allis-Chalmers Company the complete equipment for their second pumping unit, consisting of one Allis-Chalmers twin horizontal turbine, with steel plate runners, to operate under 9-foot head, direct connected, to one 39"x60" Connersville cycloidal rotary pump having a capacity of 70 second-feet through a lift of 55 feet. E. M. Chandler is manager.

TELEPHONE AND TELEGRAPH.

THE DALLES, ORE.—The Dutch Flat residents have organized a telephone company of which John Gaylor is secretary. Considerable construction work will be done.

BAKERSFIELD, CAL.—Permission was granted A. Williamson to construct a telephone line along the south side of the county road near the northwest corner of section 30, thence easterly along the south side of county road.

SAN FRANCISCO.—A bill in equity was filed in the United States Circuit Court by the McCarty Wireless Telephone Company against the Universal Wireless Telephone and Telegraph Company asking for damages for alleged infringement of letters patent.

HAYWARD, CAL.—The residents of the Fairview district, located to the southeast of Hayward, have organized the Fairview Rural Telephone Company in order to obtain an extension of the service to their houses. The officers of the company are: Thomas Nessen, president; P. B. Drake, secretary; Fred Sorenson, treasurer; Fred Cremer and Miss Agnew, directors.

SAN RAFAEL, CAL.—At the meeting of the Town Trustees it was decided to accept the bid of the Gamewell Fire Alarm and Telephone Company for the installation of a first-class fire alarm system in San Rafael. The bid calls for an expenditure of $4,700, for which price the company will furnish the municipality of San Rafael a non-interfering fire-alarm system with 25 boxes, double registers at fire headquarters and an electric alarm risen, which will give warning within a radius of 12 miles.

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